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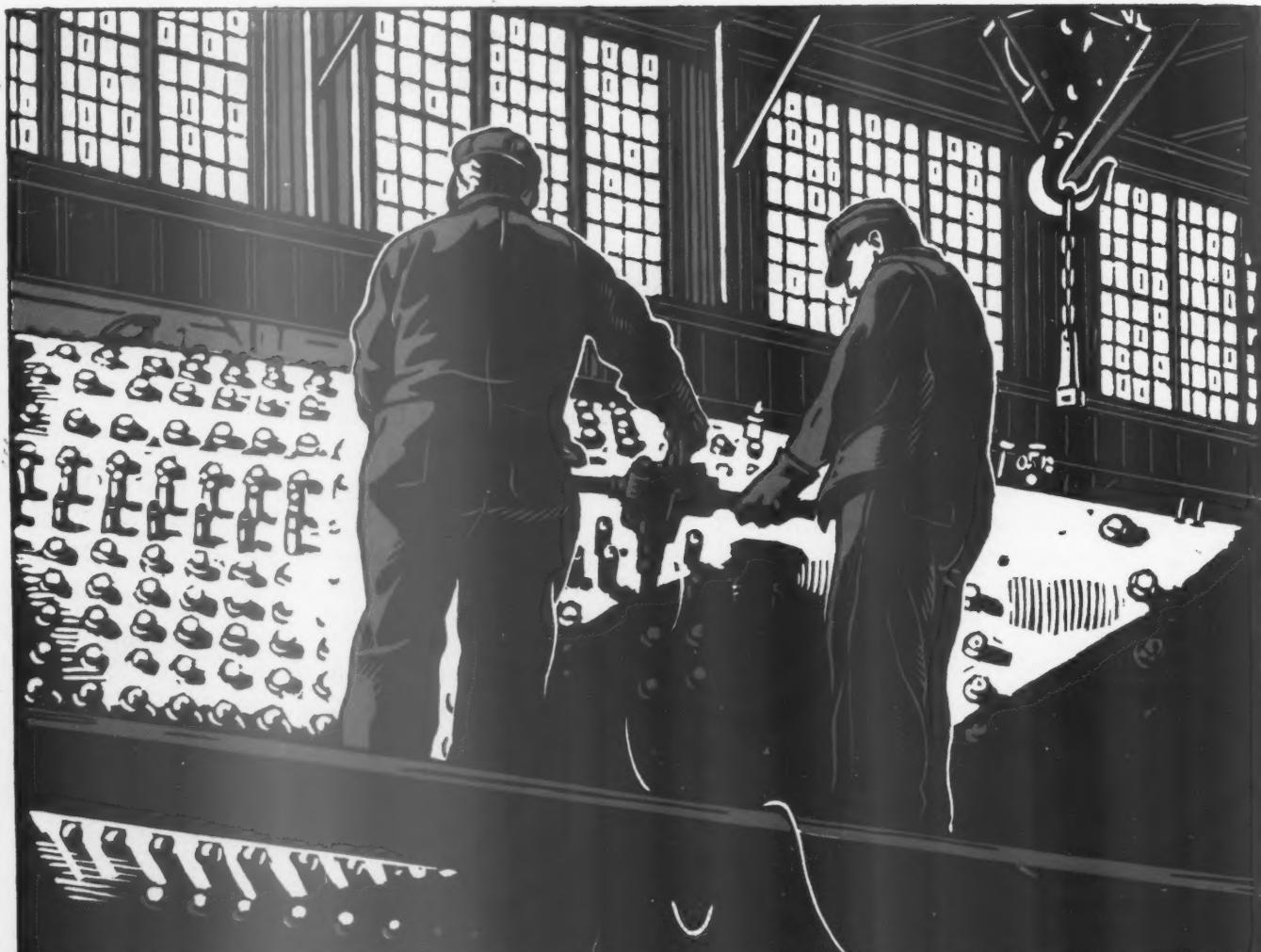
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A FEW PENNIES FOR AGATHON Saves Many Dollars in Staybolt Renewals!

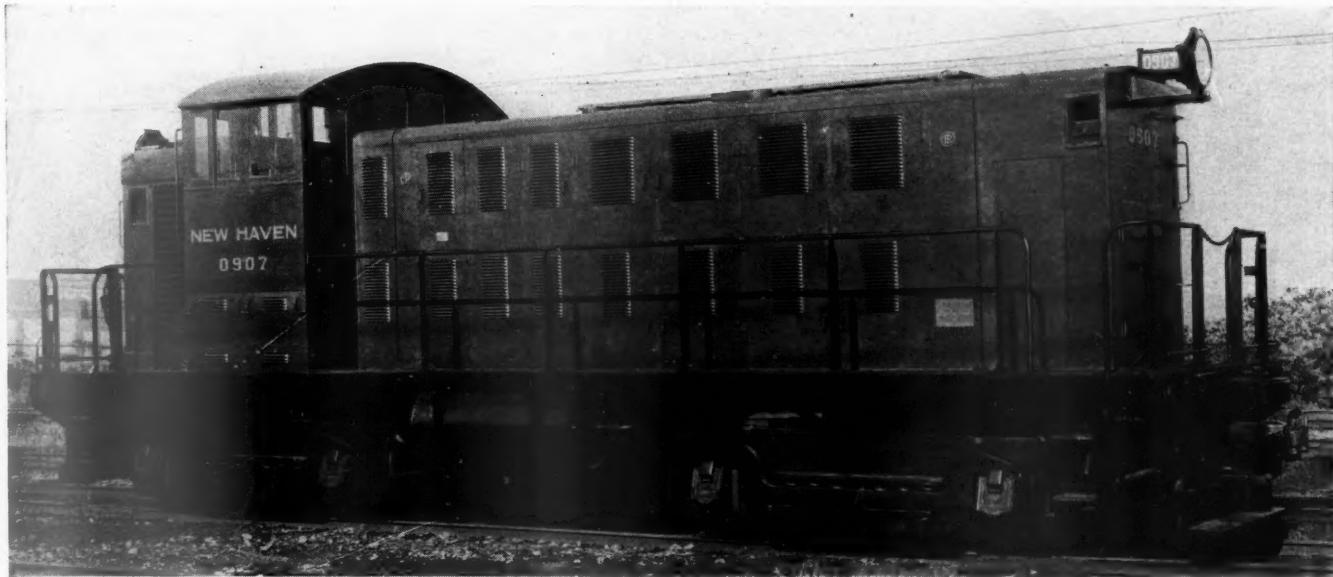
Staybolt material in the storeroom represents a relatively small cost per bolt. • • • Forged, threaded and applied, as a replacement in a locomotive, it represents more than a dollar in actual cost. • • • In many cases the out-of-service cost for the locomotive must be added to this. • • • Yet between the poorest staybolt material and the best there is a negligible difference in material cost. • • • The use of Agathon

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Ten of these Diesel-electric switchers have gone into service on the New Haven

Co-ordination of Major Equipment Units Features

New Haven Diesel Switchers

WITHIN the last three weeks the New York, New Haven & Hartford has placed in service the first of an order of ten Diesel-electric switching locomotives which involve some unusual considerations in design and equipment. Five of these locomotives are powered with Ingersoll-Rand 600-hp. Diesel engines and the remaining five with 660-hp. Cooper-Bessemer engines. The locomotives have been designed to operate at speeds not exceeding 25 m.p.h., the railroad having considered it desirable to sacrifice higher speeds of from 25 to 45 m.p.h. in return for an increase of approximately 10 per cent in low-speed performance.

In these locomotives the designers have done an exceptional job of co-ordinating the equipment in such a manner that it is possible to interchange the prime movers despite the fact that two different makes of engines are used.

Co-ordination of Equipment

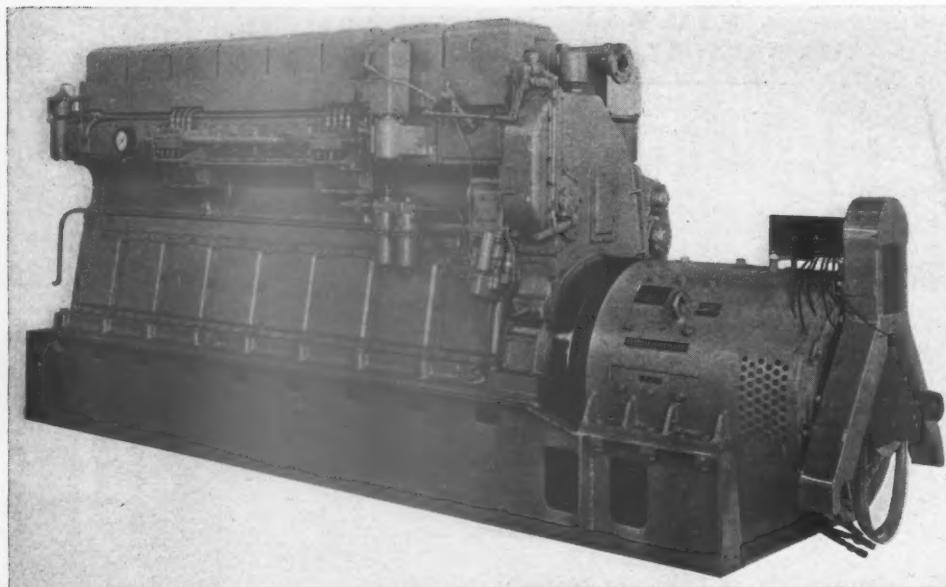
Co-ordination was carried out along three lines. One was the determination of the maximum operating characteristics of the two engines from a study of which could be designed a common set of engine auxiliaries and secondary apparatus, including parts of the electrical equipment; another was the co-ordination of all operating procedures so that with minor variations the same set of instructions could be used with locomotives having

Ten Diesel-electric units built by the General Electric Company are powered by Cooper-Bessemer and Ingersoll-Rand engines. Welded construction utilized in underframes, engine bases, cabs and trucks

either make of engine; the third was the actual employment for both engines of the same auxiliary parts.

One of the first major considerations was the design of a generator which with its field-control equipment would have a speed-torque characteristic suitable for both engines. Each builder, therefore, submitted a permissible speed-torque curve for his engine and a generator was designed with acceptable characteristics over the entire speed range. Governed speed at full load was set at 770 r.p.m. for each engine, the speed control equipment being designed to maintain speed at full load just under this, or at 750 r.p.m. It can thus be seen that there will be no conflict between engine governor and electrical governor.

To design suitable starting characteristics for both en-



Five of the locomotives are equipped with eight-cylinder Cooper-Bessemer four-cycle Diesel engines having 10½-in. by 12-in. bore and stroke and developing 660-hp. at 750 r.p.m.

gines, the engine builders furnished information regarding maximum torque required at breakaway to overcome compression at 32 deg. F., torque at minimum firing speed at 32 deg. F., and minimum firing speed in r.p.m. With this information and knowing the battery characteristics, the starting winding on the generator could be correctly designed and proportioned for starting both types of Diesel engines.

Rotation as finally agreed upon for both engines was clockwise facing the generator end.

Mechanical design of the generator and coupling as they affected the rotating systems of the engines was given very careful attention. The final design incorporated WR² and stiffness factors acceptable to both engine builders.

Idling speed was finally decided upon as 300 r.p.m. at full auxiliary load of 40 hp.

A new flexible coupling was designed for use with both engines. This coupling employs steel discs which transmit torque in compression and allow slight movements longitudinally by bending. Engine flywheels to which the couplings were attached were different, but were made suitable for attaching the same generator fan.

After collecting from each engine builder data regarding heat rejection to cooling water, engine outlet water temperature water pump delivery and head, etc., a water cooling system was designed which was suitable for both engines and which had incidentally an inherent capacity suitable for the larger engine operating continuously at full load in an ambient temperature of 100 deg. F.

A serious attempt was made to use the same water pump on both engines, but after full investigation this was abandoned and each engine was equipped with its own type of pump.

The same water temperature indicators with the same markings were designated as were identical thermostat switches set at the same cut-in and cut-out points. Similar data regarding lubricating oil were collected, and provisions made in arrangement of water radiators for the inclusion of the necessary oil radiators.

Since one engine used a nominally constant lubricating oil pressure system and the other a variable system there was some question as to the co-ordination of the lubricating-oil pressure gages. This was answered by using the same gage marked with the minimum allowable oil pressure at idling which was determined to be 20 lb. for both engines.

Two Nugent lubricating-oil filters were installed for

each engine. The filters are connected in parallel, and handle the entire lubricating-oil circulation.

Low-pressure fuel-oil systems were completely co-ordinated, and consist of a motor-driven transfer pump, a Purolator filter with .003-in. spaces on the suction side of the pump and Purolator on the discharge side, with necessary trip, relief valve, pressure gage, etc. While it was the railroad's desire to conform to its other Diesel-electric equipment and maintain 35 lb. pressure on the discharge side of the transfer pump, it was necessary to drop this to 10 lb. for one make of engine on account of characteristics of the high-pressure pump.

General Characteristics of New Haven Diesel-Electric Switchers

Total weight in working order, lb.	199,000
Light weight, lb.	190,000
Tractive force, starting (0.3 adhesion), lb.	60,000
Tractive force, continuous at 6.35 m.p.h., lb.	26,000
Maximum speed, miles per hour	25
Length over coupler knuckles, ft. and in.	41-0
Truck center distance, ft. and in.	21-0
Truck wheel centers, ft. and in.	8-0
Total wheel base, ft. and in.	29-0
Wheel diameter, in.	33
Width over cab sheets, ft. and in.	9-8¾
Heights from rail:	
Cab floor, ft. and in.	4-0
Overall, ft. and in.	13-11
Capacity of fuel-oil reservoir, gallons	400
Capacity of lubricating-oil reservoir (one engine), gallons	100

No co-ordination was attempted on the high-pressure fuel systems of either engine, partly because of the inherent differences between the so-called "common rail" and "jerk pump" systems, and partly because it was not desired that changes be made in fundamental parts of the engines.

Mufflers are made integral parts of each engine both for the sake of inter-changeability of the Diesel engines as between locomotives and to keep mufflers off the top of the locomotive to improve visibility from the cab. Suitable provisions were made in the hood around the exhaust exit so that the exhaust stacks of either engine were equally well accommodated and were hidden from view behind a low collar which conforms to the contour of the hood.

Four Air-Maze intake air filters of the same type and size were used on each engine. The housings, however, on the two were of different size and arrangement; on one the filter units themselves extended the length of the engine and came out close to the upper row of louvers in the hood; on the other there was a form of air duct at each end leading to a common housing in which were



Welding one of the truck frames

the filter units. Since this engine is narrower than the other it was necessary that filler pieces be fitted in between the louvers and the face of the ducts; these were fastened to the two hood doors opposite. To carry out the co-ordination scheme consistently, the corresponding hood doors were drilled and fitted with bolts on locomotives having the other kind of engine though of course, the filler pieces were installed only on the engine requiring them.

In order to gain a direct operating comparison between two types of speed control equipment, the Woodward governor was furnished on one type of engine, and a mechanical type with servo-motor on the other. Both engines were equipped with overspeed trip, lubricating-oil pressure relay to protect against low oil pressure, and solenoid-operated fuel shut-off device. While most of this equipment was different on the two engines, nevertheless the methods of operation were identical. The

throttle mechanism was made identical both as regards operation and adjustments.

One particularly important problem of co-ordination arose because of the fact that one engine weighed roughly 7,000 lb. more than the other and that one engine had a dry base and the other a sump base. Since both engine-generator sets in the locomotive had to be identical as to number, size and spacing of bolt holes, method of mounting, etc., the problem was settled by re-designing the sub-base of the lighter engine, making the bottom of a plate $2\frac{3}{4}$ in. thick. This new sub-base made up nearly 6,000 lb. of the 7,000 lb. difference in weight. The fact that this same engine used separate mufflers attached to it instead of the combined manifold and muffler arrangement still further reduced the difference, so that the weight discrepancy factor disappeared.

The sub-base of the engine designed for an outside sump was redesigned to incorporate in it a lubricating oil reservoir of 100-gal. capacity. This eliminated the necessity for a separate sump tank for this oil and made it possible to design similar filling, draining and gaging facilities for the two makes of engines.

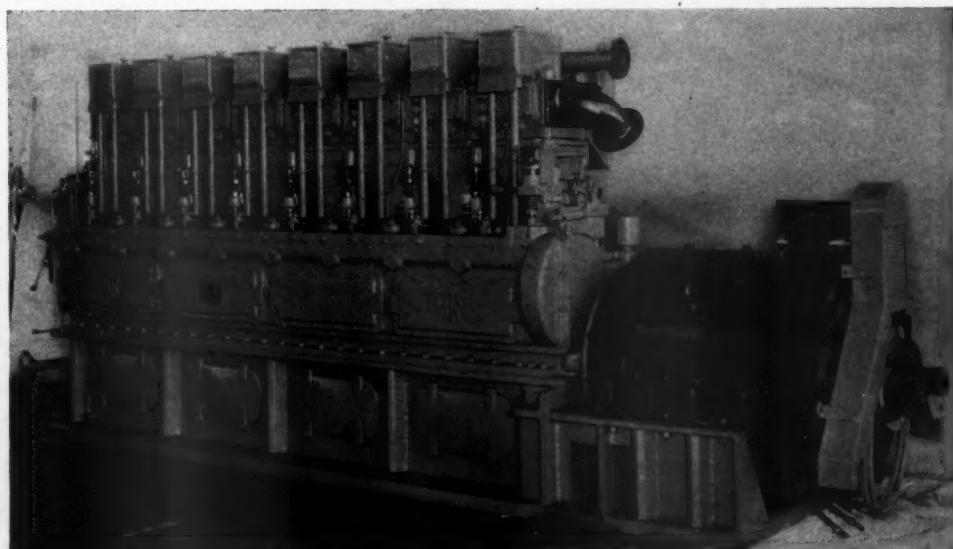
It was the railroad company's desire that the crank-case breather pipe for both engines open directly into the engine compartment without having it piped underneath or into the air intake system. Hence each engine has a 2-in. pipe fitted with a Vortex filter cap.

One of the most detailed parts of the co-ordination was the arrangement of all fuel-oil, lubricating-oil, water and drain lines on each engine so that they would connect with a common system of locomotive piping. The center line of the crankshaft and the bolting face of the generator coupling were taken as references for locating pipe connections. While doing this has resulted in both engine builders having to run extra piping on their engines, the net effect has been a uniform arrangement of locomotive piping.

Trucks

Perhaps the most noteworthy feature of the mechanical structure is the all-welded truck construction, including the truck frames. These trucks are built up of structural shapes and plates knit together by heavy fillet and plug welds. The true test of their value comes in a severe derailment, in which one of these locomotives has already been involved through no fault of its own, and these trucks have proved themselves less subject to damage than those of other construction.

The weight of the locomotive is carried entirely on



One of the five 600-hp. eight-cylinder, four-cycle Ingersoll-Rand engines showing the welded steel sub-base and generator mounting. These engines develop their rated horsepower at 750 r.p.m.



The trucks are of welded, fabricated construction—The weight of the locomotive is carried on nests of coil springs

nests of coil springs mounted between the truck frame and equalizers. The construction is simple and the riding qualities of the locomotive exceptionally good. Additional features are the combined side-bearing and locking arrangement, and the truck swivel-limiting member which is attached to the front cross tie, contacting pads on the draft-gear housing. Lateral thrust of the axle is taken by thrust blocks mounted in the journal boxes opposite the ends of the axle.

A feature of the brake work is the provision for partial brake-travel adjustment by changing the position of the upper end of the dead lever which is on top of the truck and accessible without a pit. Further adjustment is provided by the usual turnbuckle arrangement behind the equalizers.

The wheels are standard 33-in. tender wheels, thus lowering wheel costs. Journals are the collar type, 6½ in. by 12 in.

Underframe and Cab

The underframe is built up around a main slab 37 ft.-11¼ in. by 117 in. by 1½ in. forming the platform and mounted on two 37-ft.-7½-in. by 10-in. by 6½-in. center sills, running the entire length and forming a stiff backbone for absorbing buffing shocks as well as supporting the main items of equipment. Bumper beam, box structure for reinforcing the ends, draft gear housing, bolster plates, center bearings and buffers are of wholly fabricated welded construction.

The cab and hood are of welded construction throughout. The section of the hood over the engine-generator set is removable and furthermore may be removed without disturbing any of the major piping. For minor work on top of the engine, a hatch is provided in the roof.

Equipment Layout

Accessibility of the equipment was one of the major objectives of the design, since accessibility goes a long way toward assuring low maintenance costs. The following points are of especial interest: Radiator sections can be removed singly from the platform. Radiator blower motor is reached from inside the radiator compartment and lifted out through the fan cone; the radiator compartment is reached through a door in operating cab. Distributing valve is mounted in the radiator compartment and feed valves in the operating cab. Contactors, relays, reverser and other control apparatus are reached from the operating cab through folding doors and resistors from the generator compartment. Batteries are reached from the ground through drop doors on the sides of the operating cab. The generator is in a separate compartment from the Diesel engine and is reached through hinged doors from the platform. All sides of the compressor are accessible through doors in the hood. Access to the entire length of the engine from top to bottom on both sides is provided by a series of hinged doors along the platform.

Operating Cab and Control Station

Particular pains were taken in laying out the control station so as to provide greatest convenience for the operator and best possible visibility. To this end, a com-



Arrangement of the controls at the operator's station

plete dummy cab and operator's position were set up in the early stages of the design and apparatus, controls, seat, windows, etc., readjusted until it was felt the best possible arrangement had been achieved. The controls are convenient regardless of direction of operation. The operator can look across the top of either hood and see cars or locomotives on the other side, a real advantage in yard work. By putting the radiator ahead of the operating cab, no sacrifice in visibility is made and the operator is given greater protection in case of collision.

Cooper-Bessemer Engine

The eight-cylinder Cooper-Bessemer engines are the type G-N8 four-cycle arranged in line. They have 10½-in. bore by 12-in. stroke cylinders, rated at 660 b.h.p., continuous at 750 r.p.m. They are of the dry base type, carrying a structural steel sub-base, into which is built a lubricating-oil sump tank. This sub-base maintains accurate alignment of the engine and generator. The cylinder block and bottom of the crank case are cast in one piece, with removable alloy-iron cylinder liners, having top and bottom joints sealed water-tight by round rubber grommets held in turned recesses. The cylinder heads are individual castings, in which fuel nozzles, relief valves, intake and exhaust valves are all mounted and quickly accessible. The engines are equipped with aluminum pistons and 7½-in. diameter crank shafts, providing a combination which eliminates torsional vibration of any consequence within the operating range of the engine. The idling speed of these engines is 300 r.p.m. The connecting rods are high-tensile drop forgings of I-beam section, drilled full length to provide pressure lubrication to the wrist pins. The connecting-rod bearings are removable babbitt-lined steel shells at the wrist-pin end and at the top half of the crank-shaft bearing. The bottom half of the crank-shaft bearing is a babbitt-lined steel connecting-rod cap. The inlet and exhaust valves, one to each cylinder, are operated by forged rocker arms and short push rods, the lower ends of which rest against hardened cup blocks carried in guides with hardened rollers.

The injection system is the standard Cooper-Bessemer atmospheric-relief type of constant-pressure system, operating at maximum injection pressures of approximately 7,000 lb. and an idling injection pressure of approximately 4,000 lb. The cam-shaft drive, which also serves as the drive for all auxiliaries, is on the fly-wheel end of the engine and consists of a roller chain. The entire engine is enclosed, providing a dust-proof arrangement. The auxiliaries consist of a centrifugal water pump and

rotary lubricating-oil pump, in addition to the main fuel pump. There is no drive taken off the forward end of the engine, the thrust bearing being applied at that end. The engines are not equipped with torsional vibration dampeners, as they are unnecessary with this combination of crankshaft and light reciprocating weights.

Ingersoll-Rand Engines

Five of these locomotives are equipped with Ingersoll-Rand railway type Diesel engines of the vertical, trunk-piston, single-acting type, operating on the four-stroke

Partial List of Specialties on the New York, New Haven & Hartford Diesel-Electric Switchers

Builder	General Electric Co., Schenectady, N. Y.
Diesel engines	(5) Cooper-Bessemer Corp., Mt. Vernon, Ohio (5) Ingersoll-Rand Co., New York
Flexible coupling	Ingersoll-Rand Co., New York
Exhaust mufflers	Burgess Battery Co., Madison, Wis.
Air intake filter	Air-Maze Corp., Cleveland, Ohio
Lubricating oil filters	Wm. W. Nugent Co., Chicago
Gages	Consolidated Ashcroft-Hancock Co., Bridgeport, Conn.
Fuel-oil transfer pump.	Ingersoll-Rand Co., New York
Fuel-oil filters	Motor Improvements, Inc., Newark, N. J.
Electric transmission	General Electric Co., Schenectady, N. Y.
Storage battery	Electric Storage Battery Co., Philadelphia, Pa.
Traction motor fans	B. F. Sturtevant Co., Boston, Mass.
Radiators	Modine Mfg. Co., Racine, Wis.
Radiator fans and auxiliary motors	General Electric Co., Schenectady, N. Y.
Hand brakes	Ajax Hand Brake Co., Chicago
Foundation brakes	General Electric Co., Schenectady, N. Y.
Air brakes	Westinghouse Air Brake Co., Wilmerding, Pa.
Air-brake compressors	General Electric Co., Schenectady, N. Y.
Couplers	National Malleable & Steel Casting Co., Cleveland, Ohio
Draft gears	W. H. Miner, Inc., Chicago
Wheels	Carnegie-Illinois Steel Corp., Pittsburgh, Pa.
Journal boxes	Symington Co., New York
Steam-line fittings	Vapor Car Heating Co., Inc., Chicago
Steam-pipe insulation	Johns-Manville Corp., New York
Cab radiator	Rome-Turney Radiator Co., Rome, N. Y.
Clear-vision windows	Prime Mfg. Co., Sydney, Ohio
Fire extinguishers	Pyrene Mfg. Co., Newark, N. J.
Sanders	Walter Kidde & Co., Bloomfield, N. J. Graham-White Sander Corp., Roanoke, Va.

cycle with direct fuel injection. The cylinders, eight in line, are 10-in. bore by 12-in. stroke, and the engines are rated at 600 hp. at 750 r.p.m. The engine sub-base, which supports the engine and generator, is of welded steel construction, extending the full length of the engine, and forms an oil sump for the engine. The cylinder block and upper portion of the crankcase is cast in one piece, with removable cylinder liners. The crank shaft is a one-piece forging, with main bearings 6¼ in. in diameter, drilled to provide passage for the lubricating oil to the main and crank-pin bearings. The crank shaft is counterbalanced. The connecting rods are one-piece drop forgings, with a solid eye at the piston pin end. The connecting rods are drilled for wrist-pin lubrica-



Fabricated platform for New Haven locomotive showing underside construction with fuel and air tanks

tion. The wrist-pin bearing in the connecting rod is a bronze-lined steel shell, pressed into the eye. The bearing at the crank-shaft end is an interchangeable babbitt-lined steel shell, with a cap forming the bottom half of the bearing. The pistons are of cast iron, ground to size. They contain five compression rings and two oil-control rings. The hollow steel piston pin is of the floating type, and is prevented from coming in contact with the cylinder walls by two brass cover plates, which are held in place by a threaded tube passing through the piston pins. The cylinder heads are individual castings. Each containing one inlet and one exhaust valve, and two opposed spray nozzles. Flanges on the cylinder heads bolt together, forming an integral water-jacketed exhaust manifold.

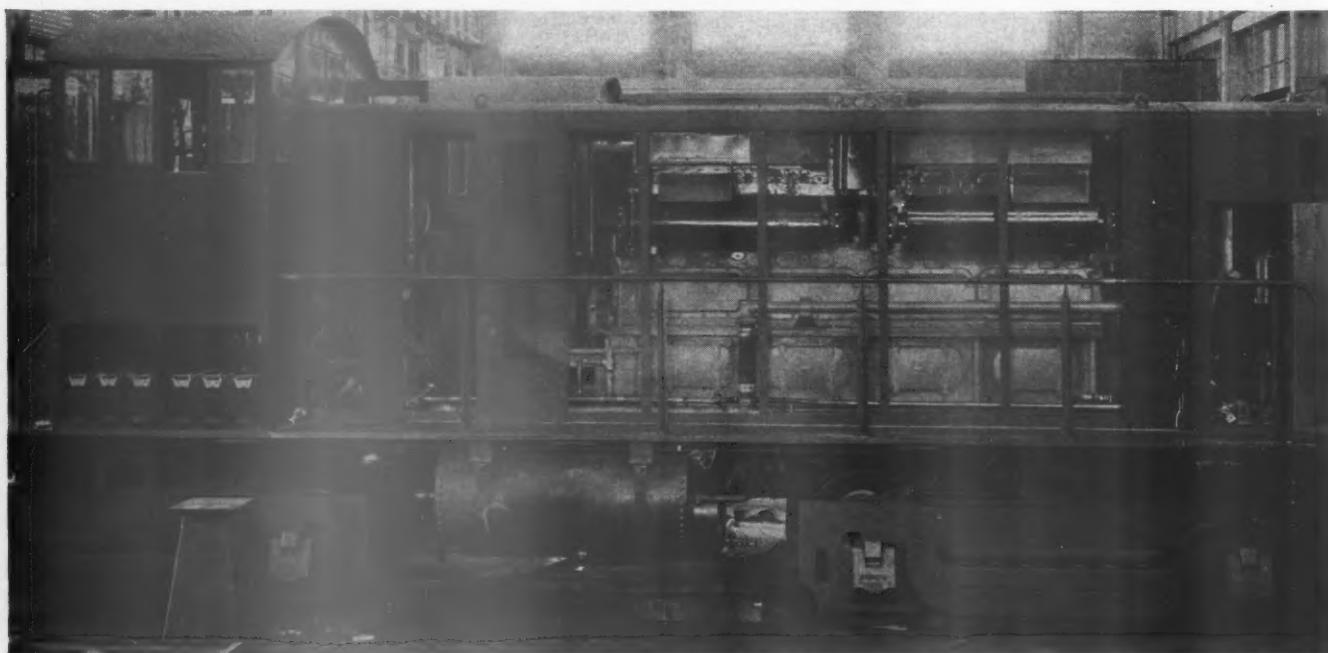
The camshaft carries inlet, exhaust and fuel-pump cams, governor driving gear and over-speed governor. The inlet and exhaust valves are actuated by rocker

strainer, filters, cooling radiators and thence to the engine bearings. The lubricating-oil system is provided with an electric safety switch which stops the engine in the event of failure of the oil supply.

Transmission

The generator is driven through a flexible coupling, the generator being mounted on an extension of the engine sub-base. The generator output varies with engine speed in the conventional way as on any variable-speed engine equipment. At full throttle full engine horsepower is utilized at all speeds from approximately 2 to 15 m.p.h. thus assuring maximum performance of the locomotive within the entire range of switching operation. The excitation is the combined self and separate type.

The traction motor equipment consists of four General Electric type 724 motors which are axle hung,



One of the New Haven locomotives under construction at the General Electric Works at Erie, Pa.—The covers have been removed to show the engine, generator, control and batteries

arms and push rods. The camshaft drive from the crank shaft is by means of an idler gear support on ball bearings. The fuel system consists of a Cameron cam pump motor set, which draws fuel oil from the storage tanks and delivers it under pressure to a filter. Constant fuel pressure is maintained at the filter by a relief valve. From this point fuel oil flows through a header to individual injection pumps, which deliver properly timed and metered quantities of the fuel to the two spray nozzles in each head.

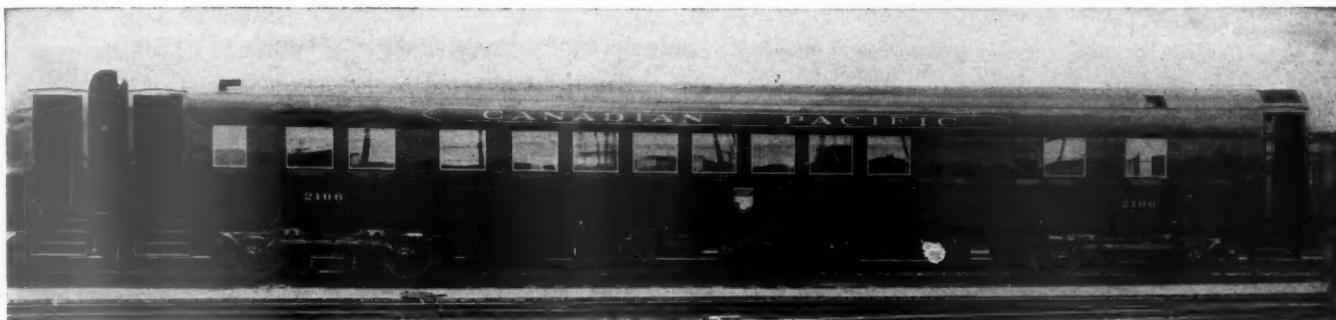
The engines are equipped with a dynamic hydraulic vibration damper, located on the end of the crank shaft away from the generator. The engine governor is driven through bevel gears from the crank shaft, and controls the quantity of fuel delivered to each cylinder. A servo-mechanism is employed to control the governor. The water-cooling system consists of a centrifugal-type pump driven from the crank shaft which delivers water to the jackets of the cylinders and heads. Force-feed lubrication is provided for all wearing parts of the engine. The lubricating-oil supply is stored in the engine sub-base and oil circulation is provided through the medium of a gear-type pump, driven from the crank shaft. Oil drawn from the sub-base passes through a suction

nose suspended units with double reduction drive. There are several reasons for going to a double reduction motor on this equipment. For switching service where the majority of the work is done at speeds of 5 to 8 m.p.h. and maximum speeds rarely exceed 12 to 15 m.p.h. it seemed logical to design a motor the best efficiency of which would occur in this low speed range limiting the maximum speed to about 25 m.p.h. which would take care of transfer work and light movements. Moreover, the armature becomes a high-speed unit and hence comparatively small. The net result is that the GE-724 motor complete with gearing and all accessories weighs 4,500 lb. against 8,100 lb. for motors used previously in similar applications. The smaller motor permits the use of a standard 33-in. tender wheel.

The continuous tractive force rating of each motor is 7,000 lb. giving a total rating of 28,000 lb. at approximately 6 m.p.h.

Traction motors are permanently connected two in series on each truck and two motor connections are used series-parallel full field and series-parallel shunted field. There is no transition other than the change from full to reduced field.

(Continued on page 537)



First-class coach

C.P.R. Builds

Light-Weight Coaches

LATE last summer the Canadian Pacific completed 16 light-weight passenger-train cars of three types for use in high-speed local passenger service. There are four combination mail and express cars, four combination baggage and buffet coaches, and eight first-class coaches with large men's and women's lounges. These are assigned to four trains which will be hauled by the new high-speed steam streamline 4-4-4 locomotives delivered to the railroad by the Montreal Locomotive Works during the past summer.*

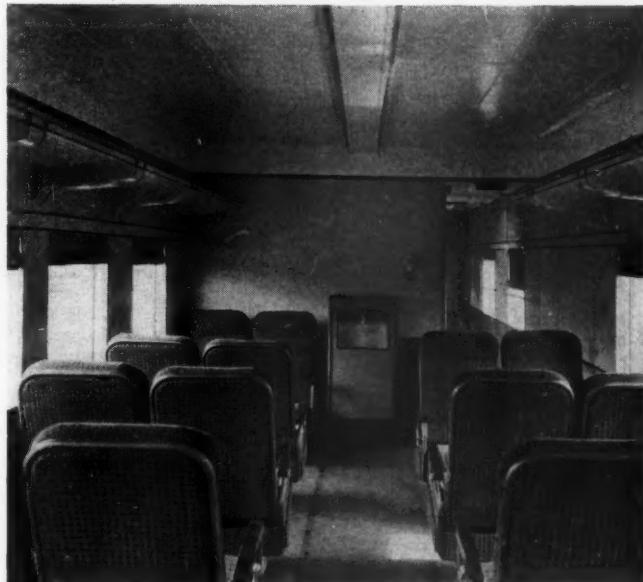
The new equipment was designed by the mechanical department of the railroad. The frames of the cars were built by the National Steel Car Company, Hamilton, Ont., and finished at the Angus shops of the Canadian Pacific at Montreal. One of the principal objectives in the design was to reduce weight. This has been done, however, by refinements in the distribution of material rather than by the employment of special alloy structural steels. With the exception of the platform end posts, which are of Man-Ten steel, the entire structure is of carbon steel. With a few exceptions, the entire structure is built by welding. The actual weights are as follows: Combination mail and express, 107,700 lb.; combination baggage and buffet coach, 114,000 lb.; first-class coach, 110,000 lb.

The Body Structure

In the design of these cars the railroad has adopted a roof of oval section without clerestory and relatively flat across the top. This has been worked out on a basis to permit its universal use for new equipment, sleeping cars as well as coaches.

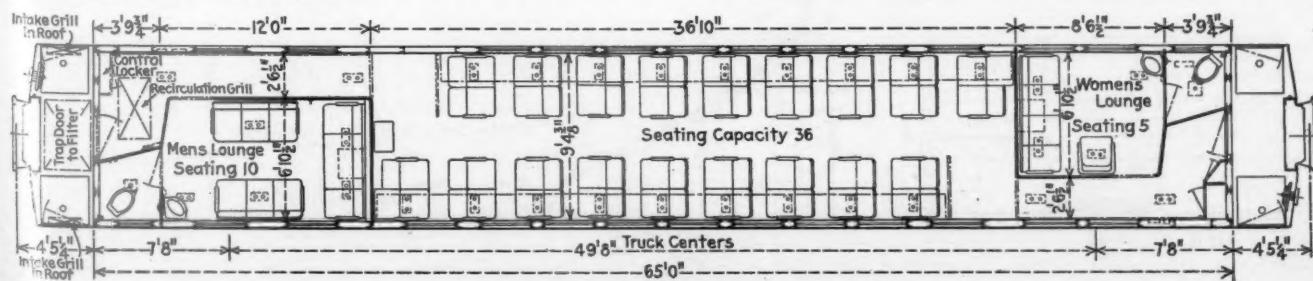
The body structure departs materially from the cus-

Unique design employs carbon steel in three classes for high-speed local train service. Passenger-carrying cars are air conditioned

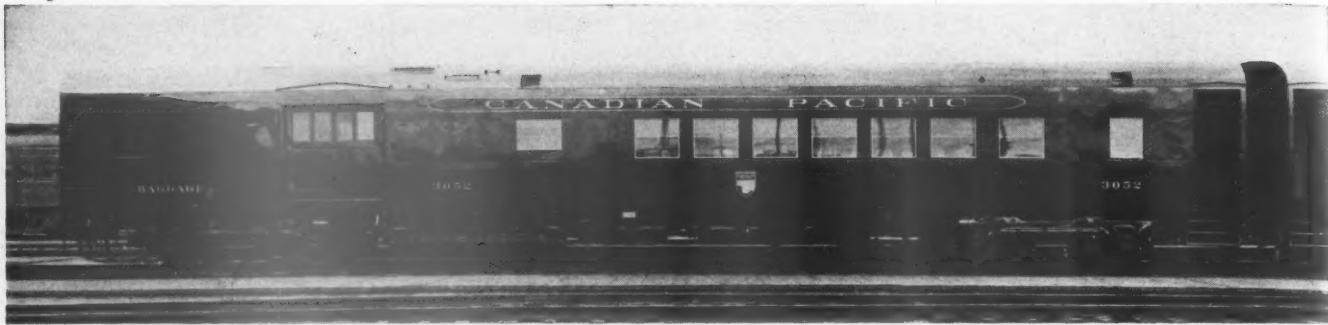


Interior of one of the first-class coaches

tomy side and roof units in which the side-plate forms the top chord member of the side frame and the base



Floor plan of the first-class coach



Combination baggage-buffet coach

for the attachment of the roof structure. The side posts, which are of channel section pressed from $\frac{1}{8}$ -in. steel, continue well upward into the roof curve where they are fitted into 4-in., 5.4-lb. channel longitudinal members. The carlines, which extend across the car in one piece to complete the roof frame, are likewise framed and welded to channels of the same section, and the two channels at each side are riveted together, back to back. Longitudinals are fitted and welded between the carlines, one on each side about 2 ft. from the center line.

Window-sill pressings are welded to the posts and where the outside pier-panel cover plates join the side sheathing at the window-sill level and the letter-board sheathing above the windows there is a 2-in. by $1\frac{1}{2}$ -in. by $\frac{1}{8}$ -in. angle welded to the posts and sheets.

Extending from the top of the letter board over the sharper portion of the roof to a point 3 ft.



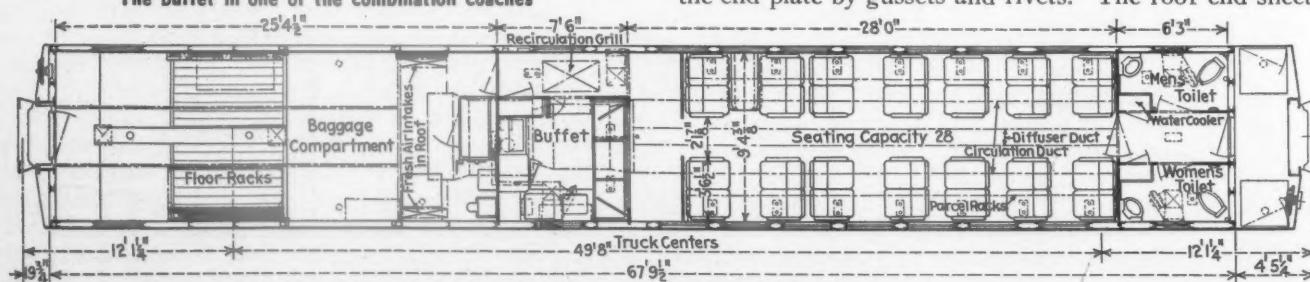
The buffet in one of the combination coaches



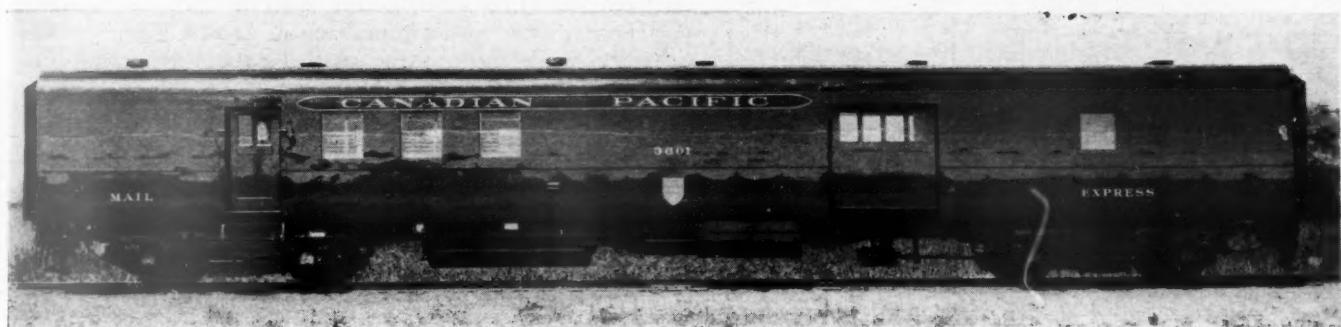
End equipment of the Canadian Pacific passenger cars

$1\frac{1}{2}$ in. from the center is a $\frac{1}{8}$ -in. roof plate which is flanged inward at the upper end between the posts and carlines, thus serving as longitudinal stiffeners at these points. It will be noted that this plate covers the joint between the side posts and carlines. The middle of the roof is covered with $1/16$ -in. plate which overlaps the thicker sheets at the sides.

The end structure is built up on double posts of the same section as the side posts, with 4-in. Z-bars at the corners. The platform end posts are 8-in. Man-Ten channels secured at the top by angles and gussets which are in turn fastened to an 8-in. channel end plate laid with the flanges up. The ends of the end plates are fastened to the upper chord members by means of gussets. The door posts and corner posts are fastened to the end plate by gussets and rivets. The roof end sheets



Floor plan of the combination baggage-buffet coach



Mail and express car

($\frac{1}{8}$ -in. thick) extend over the platform to the vestibule end sheet to which it is shaped and welded.

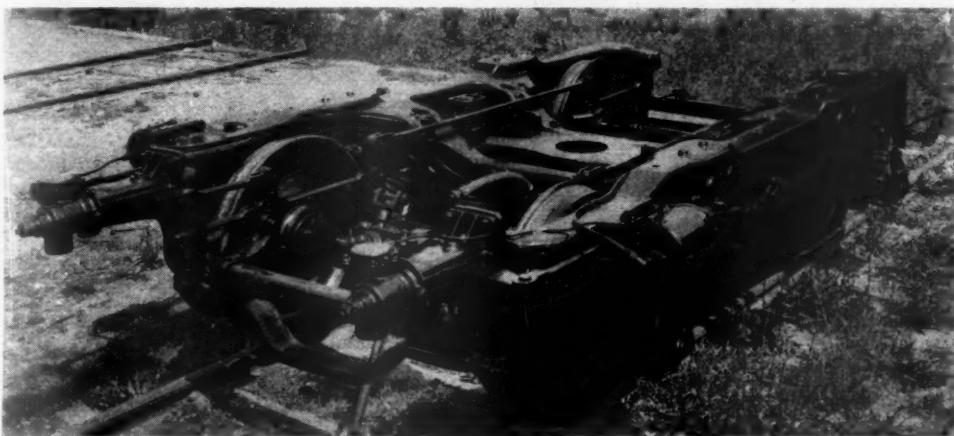
Rivets are used in the car structure on the sides of the car where the letter board and roof sheet are joined, at the joint of the pier-panel cover plate and side sheathing at the window-sill level and where the side sheathing is secured to the side sill. The use of rivets at these points was dictated primarily by considerations of appearance. Another exception from the general use of welding is the joint between the channel longitudinals at the ends of the side posts and carlines. Another is the attachment of the bolster center-brace to the sills.

It will be noted that the side posts are curved inward slightly below the window-sill level. This was done to

the length of the car. The bolsters and these floor beams, the latter of which rest upon the top of the center sills, are framed and welded to 5-in. by $3\frac{1}{4}$ -in. by $5\frac{1}{16}$ -in. longitudinal Z-bars at the sides of the car. The side sill is completed by welding a 2-in. by $2\frac{1}{2}$ -in. by $3\frac{1}{16}$ -in. angle to the outward projecting bottom flange of the Z-bar, thus providing a continuous surface to which the bottom of the side sheathing is attached.

Interior Finish and Fittings

The interior of the car is finished with $5\frac{1}{16}$ -in. Masonite on the side and $\frac{1}{4}$ -in. Sundeala on the ceiling. The ceiling is flat for 7 ft. 6 in. between the curves by which it joins the sides of the car. In the space between



One of the trucks

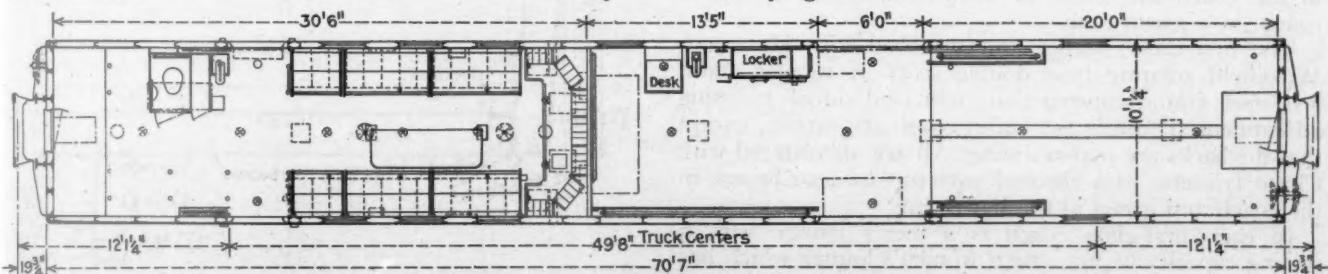
reduce the appearance of waviness in the highly polished finished surfaces of the sides of the car.

One of the interesting features of the underframe is the use of the A.A.R. standard freight-car center-sill section which has been built up by joining two $12\frac{1}{8}$ -in. by 36.1-lb. Z-section members. The bolsters are built up of $5\frac{1}{16}$ -in. steel-plate webs and flanges which are joined by welding. Where the webs have been cut away the openings have been reinforced by welding on additional $5\frac{1}{16}$ -in. plates. The cross-members are 5-in. 6.7-lb. channel floor beams, of which there are twenty in

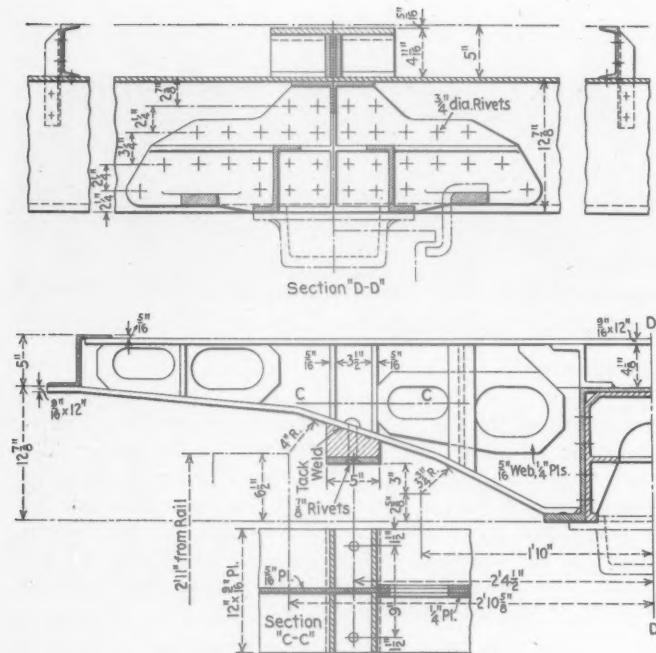
the roof and the ceiling is an air duct with a cross-sectional area of 280 sq. in. with openings leading into the distribution duct below the ceiling, from which the conditioned air flows into the passenger compartments. The duct is covered with $\frac{1}{2}$ -in. air acoustic, outside of which is $\frac{1}{2}$ in. of insulating material. Above the air duct, between the purline sections in the roof frame, 1 in. additional Salamander insulation has been inserted.

The windows are of double glass, dehydrated, permanently secured in place, and are flush on the outside.

In laying the floor the floor beams are first covered



Floor plan of the mail and express car



Details of the welded bolster

with pressed pans of 20-gage steel which are depressed between the beams. Next is laid the insulation which consists of $\frac{1}{2}$ -in. Hairinsul and $\frac{3}{4}$ -in. Salamander. Above this is laid a longitudinal wood under-floor of $1\frac{1}{4}$ -in. tongue-and-groove material and a transverse top floor of $\frac{5}{8}$ -in. tongue-and-groove with a layer of asphalt paper between. All floor joints are sealed with mastic. The sides and roof are insulated with $1\frac{1}{2}$ -in. Salamander which is placed against the outside of the car with a layer of Johns-Manville deadening felt cemented to the steel.

The ornamentation of the interior of the cars is relatively simple. Aside from the center distribution air duct, which breaks up the continuity of the ceiling, and the special aluminum basket racks, it is confined to striping between the ceiling and the side and end walls, above and below the curtain moldings over the windows and at the window-sill line.

The ceilings on both the buffet and the first-class passenger coaches are finished in light cream. The pier sections and end walls of the coach are finished in a darker cream at the top, shading down to drab at the wainscoting, which is brown. The floor is covered with marbleized brown linoleum with the aisle strip outlined by black stripes. The striping between ceiling and wall colors, over the windows and between the walls and wainscoting colors is in dark brown. The basket racks are finished in the wall color, relieved on the edges and on the brackets by black striping. The buffet coach is similarly finished, except that the walls shade down to green on the wainscoting and the floor is covered with green marbleized linoleum. The roller window shades in the coach are faced in brown; those in the buffet coach, in a green tone.

The first-class coaches are furnished with Heywood-Wakefield rotating type double seats of tubular stainless-steel frame construction, with individual reclining adjustment. Those in the buffet coach are similar, except that the backs are non-reclining. All are upholstered with Chase friezette in a checked pattern—tobacco brown in the coach and green in the buffet car.

In each first-class coach is a men's lounge with a seating capacity of ten, and a women's lounge which has seats for five persons. The sofa seats in both lounges

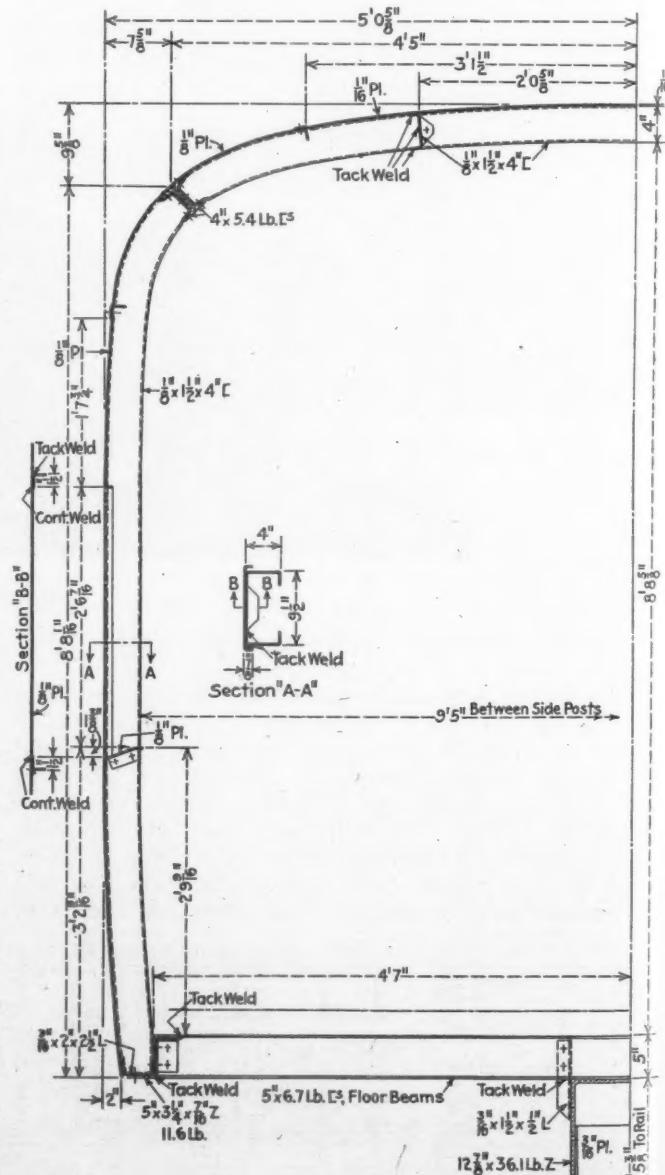
have the same angle as the seats in the coach section. Those in the men's room are in brown leather upholstery, while those in the women's room are upholstered in the same material which is used on the seats in the main room of the car. Men's and women's toilets are located in the end of each buffet coach.

With the exception of space for a side aisle, the buffet occupies 7 ft. 6 in. across the front end of the passenger compartment in the combination baggage and buffet coaches. It is equipped to serve light meals and refreshments and also provides newsstand service. Meals or refreshments can be served at the counter or at four double tables arranged between the first two pairs of seats on each side of the aisle.

The exteriors of the coaches are finished in Tuscan red, the standard Canadian Pacific coach color. The roof is in black and the name of the road is lettered in gold on a black letter-board panel which is also outlined in gold. The trucks and under body are painted black and black stripes are applied under the windows and at the bottom of the sides.

Lighting

Thirty-volt lamps are used for train lighting to insure that lamps will burn at full rated candle power from



Structural cross-section of the Canadian Pacific passenger cars

the battery when the generator is not working. With a few exceptions, the cars are lighted entirely by Safety prismatic glass fixtures placed on the underside of the baggage racks. Each fixture is equipped with two 25-watt lamps controlled by a toggle switch on each unit. This type of unit will distribute the light so that the intensity is only slightly greater over the aisle seat than over the window seat, and is designed to provide an intensity of 12 foot-candles on the 45-deg. reading plane. Similar fixtures are used in the passageways and smoking rooms, but these fixtures are not individually controlled.

Single 25-watt Safety lighting fixtures are used in the toilets. There are also 25-watt lamps in the equipment lockers and over doors and desks in the mail and baggage compartments. General illumination in the mail and baggage compartments is provided by 75-watt lamps in RLM type enameled-metal fixtures.

Air Conditioning and Heating

The combination baggage and buffet coaches and the first-class coaches are all equipped with ice-activated air-conditioning systems. Both the recirculated and outside air brought into the cars is passed through a series of water sprays. A thermostatically controlled motor-operated by-pass valve delivers water from the ice box or the sump to the sprays, depending on the amount of cooling required.

A motorized damper energized through the panel setting varies the amount of fresh air, giving 25 per cent on cooling and heating and 100 per cent on ventilation only. A large dial thermometer in the air-conditioning control locker shows outside temperature and indicates to the trainman which of three settings—high, low and medium—is to be selected to produce best air-conditioning results.

The cars are heated by the Vapor system under thermostatic control which is interlocked with the air-conditioning control. Floor heat is obtained from fin-tube radiators at the usual location and is supplemented by top heat which is distributed through the air-conditioning ducts.

Power Supply

Electric power for the coaches is supplied by 4-kw. Stone generators driven by a Stone-Cush or Hatcher drive, which consists of a split cast-steel gear mounted on the axle, driving a bronze worm. The worm is connected to the body-mounted generator through a splined shaft and automatic clutch. The clutch completely disconnects the generator from the drive when the car is running at low speeds or when it is standing. This allows for motoring of the generator, an easy inspection of the commutator, and also relieves the drive and generator from switching shocks. The clutch engages the generator at a speed of about 10 miles an hour. Drives of this type have now been in service on the Canadian Pacific for more than 600,000 miles.

Mail and express cars are equipped with Pitt drives. These consist of a split steel gear, mounted on the axle, driving the splined shaft through spur and bevel gears. These drives replace the older Stone generators in which automatic generator output regulation was obtained by slipping of the belt. This change necessitated the use of generator regulators. Lamp voltage is controlled by 75-amp. Stone lamp regulators.

The batteries on each car have a capacity of 450 amp. hr. and consist of 25 type A-12-H Edison cells.

The Trucks

The cars are equipped with four-wheel trucks having Commonwealth nickel cast-steel frames and bolsters.

Those under the mail and express cars have 5½-in. by 10-in. axles with Timken roller bearings. Those under the other two type of cars have 5-in. by 9-in. axles with Fafnir roller bearings on the first-class coaches and Matco roller bearings under the combination baggage and buffet coaches. The springs are of chrome-vanadium steel. All trucks are equipped with the Simplex unit-cylinder clasp brakes with Westinghouse automatic slack adjusters.

The trucks have no center pins and are equipped with a special lock which is being used for the first time on the Canadian Pacific. The body center plate is seated in a relatively deep bolster recess and the two are locked together by retainers attached to the body bolster which hook under the flanges projecting laterally beyond the front and back sides of the bolster.

Another interesting feature of the trucks is the complete profile turning of the 36½-in. rolled-steel wheels, which are thus brought into static and dynamic balance.

Fabreeka sound-deadening material is applied to the spring planks, the transom wear plates, under the side bearings and on the pull-rod guides and cylinder-lever supports. It is also used back of the upper buffer springs and around the buffer side and center stems.

The cars are fitted with Ajax single-fold diaphragms and Miner spring buffers. The mail and express cars and the combination baggage-buffet coaches are equipped with Cardwell PF6 draft gears, while the first-class coaches are equipped with the Miner A5XB type. The draft gears are designed to go solid before the buffers so that the over-solid load is delivered on the center line of the coupler. The couplers are long-shank A.A.R. Type E with swivel butts, and are carried on pendulum type centering devices. The air-brake equipment is Westinghouse Schedule UC-4. The cars are equipped with Vapor or Barco 2-in. metallic steam-heat connectors.

Exhibition Service

Following completion, the new trains were taken on exhibition tours, amounting to a total of 7,500 miles, and during that time were visited by more than half a million people. Then, after a period of revenue service on experimental schedules, they were put on their regular runs on September 27, in each instance in relatively fast local service with a large number of stops. Two trains have been assigned to the Montreal-Quebec service which involves a 4½-hr. schedule for the 173-mile run in each direction, including 32 intermediate stops. One train, with two locomotives, has been assigned to the Toronto-Detroit run. This train has been christened "The Royal York," and will make the round trip between Detroit and Toronto daily, making the 229-mile one-way run in 5 hr. 35 min., both eastbound and westbound, with 19 intermediate stops in each direction. The fourth train, named "Chinook," will run between Calgary, Alta., and Edmonton, making a round trip daily and completing the 194-mile run in 5 hr. 15 min., with 22 intermediate stops in each direction.

TRANSATLANTIC AIR PILOT FORMER RAILWAY MAN.—Dick Merrill, noted airplane pilot who recently took Harry Richman safely across the Atlantic and back, was a locomotive fireman for the Illinois Central at Jackson, Miss., several years before and after the World War and a locomotive engineer from 1920 to 1925. Visiting aviators at Jackson lured him away from the railroad during the latter year. His airplane service has been principally as a mail pilot on the Eastern seaboard. One of his airmail exploits was saving a farm family from a night fire by circling low enough for the noise of his motor to awaken the sleeping members.

Locomotive Parts*

THREE is an old saying which aptly applies to this article, "The best laid plans of mice and men gang aft agley". The engineer in designing a locomotive is apt to overlook the fact that the finish on a part may fall far short of the standard on which he based his calculations. A highly-polished finish on a test piece gives maximum physical properties for the material tested, whereas the actual finish may be such that the physical properties are perhaps less than half of what they should be. As a result, the part fails in service, not because of poor design, but because of inferior finish.

In inspecting some finished parts which were purchased from manufacturers, the finish was found to be far from desirable. The drawings clearly indicated the kind of finish we desired, but it developed that the manufacturer's standards were on a different basis and not at all according to our ideas. A failure of a part because of this rough finish resulted in an expense of over \$3,000.

If the designing engineer could see the finish of some of the parts which he designed, I am afraid he would not sleep very well. In inspecting a locomotive part I found some oil holes filled with grease and waste. Why? To protect the holes from filling with dirt? I had them cleaned out and found that they were made by drilling from both ends. They met in a weak section of the design; the center lines of the drilled holes were about the radius of the hole apart. Certainly this is not the right sort of hole through which oil could pass freely and, certainly, also, it provided a splendid starting point for a fatigue crack. What is an engineer to do when such parts fail?

One means of lubricating the large end of a main rod is to have a boss for the grease cup on the top of the rod. This boss is drilled to form the cup, with a smaller drilled hole through which the grease can pass to the crank pin. Such a design, with a proper machine tool finish, with the edges of the drilled holes rounded and with proper fillets and freedom from welds, will last indefinitely. Unfortunately, some of these factors may be overlooked and the rods fail. Fatigue cracks start from torn surfaces or tool marks, and the lack of a proper fillet or rounded edge may concentrate the stresses in such a way as to start fatigue cracks.

Sometimes a hole may be drilled too large. It is then filled in by welding and a smaller hole drilled through the welded metal. This is a questionable practice since it frequently leaves conditions favorable to the starting of fatigue cracks, as indicated in some of the illustrations.

Failures of the types above mentioned are not infrequent. We had a rod crack four months after being placed in service, because every edge of the grease cup holes was rough or burred. As a result, two deep cracks were found. Rounding the edges would have removed the burrs or roughnesses and insured a long life.

A side view of a broken main rod is shown in Fig. 1. The fractured surfaces are shown in Fig. 2. It will be noted that there is a boss at the top for the grease cavity and that the bottom is weakened by the drilled and tapped hole for the stop plug. The bottom of the hole at the top had been partially filled in by the electric

* Part six of an article which began in the May, 1936, issue.
† Assistant test engineer, Canadian National Railways.

By F. H. Williams†

welding process. The break was caused by two fatigue cracks. One of these started at the electrically deposited metal in the side of the grease hole. An enlargement of this fractured section is shown in Fig. 3. The other fatigue crack was caused by an edge which had not been properly rounded off. This fractured section is shown in an enlarged photograph, Fig. 4. The break at the bottom section of the rod is of coarse structure, indicating that it was fractured suddenly, after the top section had given way, and not due to weakness in design of this bottom section. Since the boss at the top of the rod introduces complications as to machining, etc., it might be better to redesign this type of rod, leaving the boss off and using a detachable grease cup, thus corresponding to the cross section of the rod at the bottom with the stop plug hole.

The fractured section of another side rod which failed in service is shown in Fig. 5. This rod had a boss at the top for the grease cup, but there was no stop plug hole through the section at the bottom. The fatigue crack started at the edges of the grease hole, which were rough and were not properly rounded. There were no fatigue cracks in the break at the bottom; apparently it fractured suddenly after the top section had given way. Here, again, it is quite clear that while the enlargement at the top may not have been responsible for the failure, the improperly finished surfaces and edges caused a concentration of stresses, which in combination with the boss, resulted in the failure.

Still another example of a main rod which failed in service is shown in Figs. 6 and 7. In this instance there are bosses at both the top and bottom, although the lower one is smaller. It would appear that the section at the top should be much stronger than that at the bottom. As a matter of fact, fatigue cracks started at the edges of the grease hole on both sides at the top. The same thing is true, also, at the bottom, due apparently to the sharp edges of the stop plug hole.

Other examples of fractures through bosses on main rods are shown in Figs. 8 and 9. They are of special interest because in the case of Fig. 8, the progress of the fatigue cracks is so clearly shown. This is true to a certain extent also of the rod shown in Fig. 9, although here conditions are complicated somewhat by the deposit of welded metal in the hole leading from the grease cup to the crank pin. Clearly something is wrong with the design, or the workmanship, or both.

When the finish of the edges of oil or grease holes is mentioned to the average shop man, he merely smiles and

Fig. 1—Side view of broken main rod with boss for grease cup at the top. Fig. 2—Fractured surfaces of broken main rod shown in Fig. 1. Fig. 3—Enlargement of section in Fig. 2, showing nucleus of fatigue crack, that started at the edge of the metal, which was filled in by the welding process. Fig. 4—Enlargement of the section in Fig. 2, showing the progress of the fatigue crack that started from the corner, which was not properly rounded. Fig. 5—Fractured sections of another rod which failed in service because of improperly rounded corners. Fig. 6—Side view of a main rod which failed in service. Fig. 7—Fatigue cracks started at four places, as indicated, because of sharp edges.

BOSS for GREASE CUP → ← LINE of FRACTURE

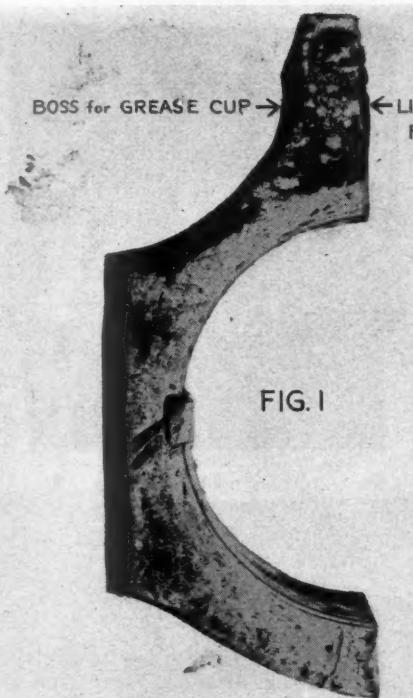


FIG. 1

NUCLEUS of FATIGUE CRACK

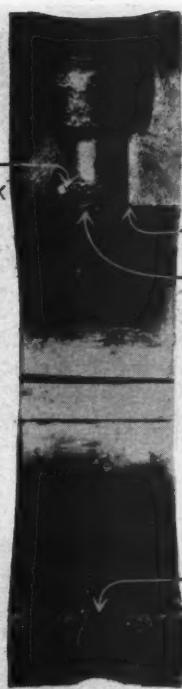
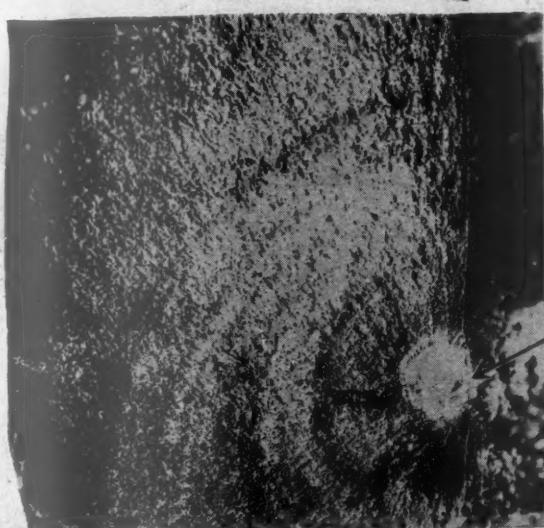


FIG. 2

FIG. 3 FIG. 4

NUCLEUS of FATIGUE CRACK
DEPOSITED METAL
NUCLEUS of FATIGUE CRACK
CORNER TOO SHARP



NUCLEI of FATIGUE CRACKS



FIG. 5

FIG. 6

← ROUGHNESS of FRACTURE INDICATES SUDDEN BREAK

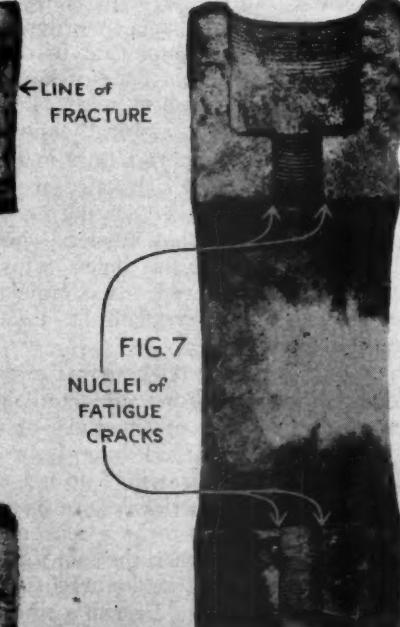


FIG. 7

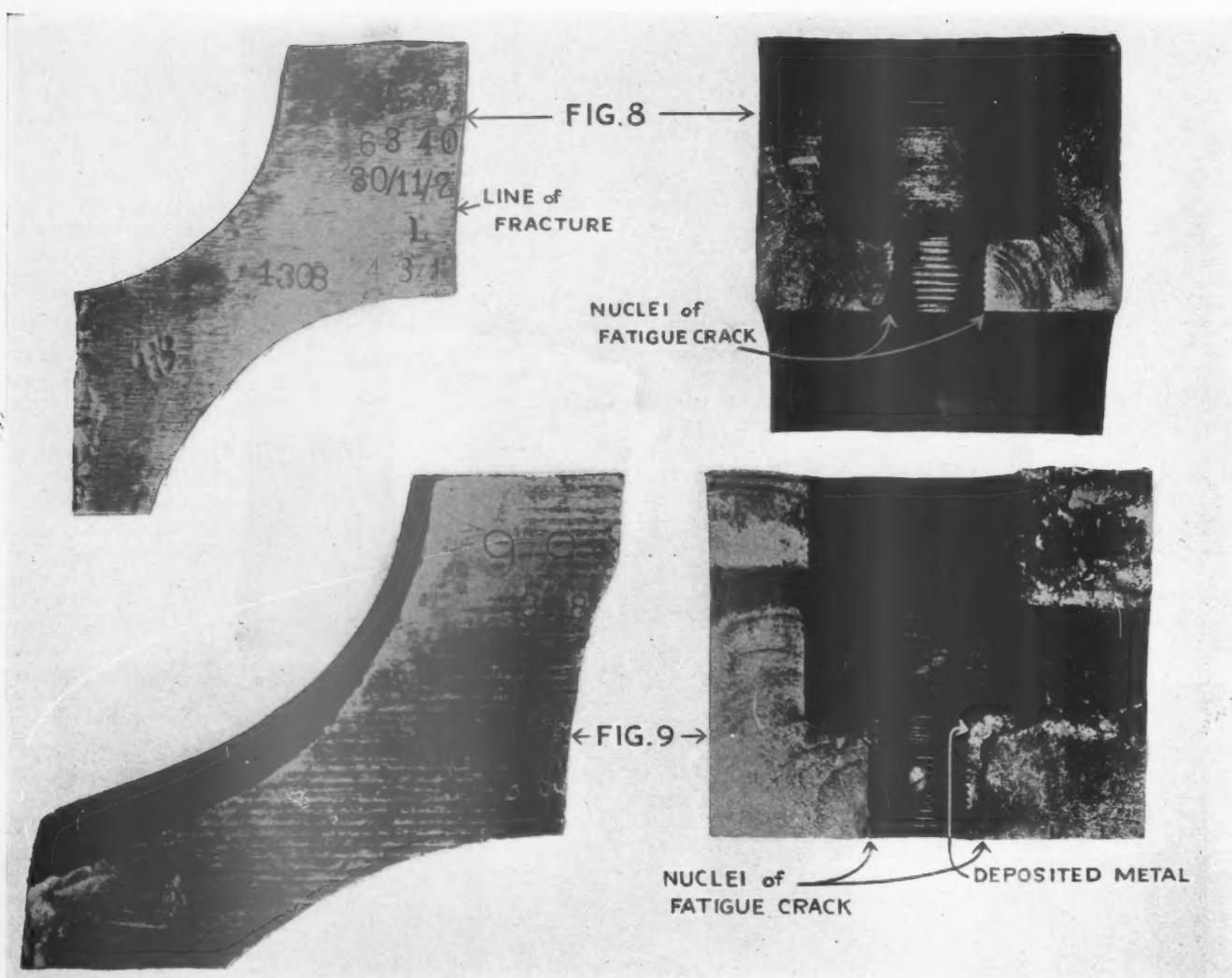


Fig. 8—The progress of the fatigue cracks is clearly shown for this main rod, which failed in service. Fig. 9—Deposited metal to fill the grease plug hole complicated conditions in this broken side rod

goes right on with his wickedness, although it is evident from the many examples of failures that neglect of this sort may lead to serious accidents.

In sending a telegram or in dispatching a train, it is the practice to repeat the message, or order, so that there may be no mistakes. It is somewhat in this spirit that I am reiterating the vital importance of having the edges of drilled holes properly finished, with suitable rounded edges, smoothly finished. This naturally eliminates coarse filing. When a side or main rod fails in a few months because of departure from this practice, it is surely time to take notice and to see that it does not occur again.

There is another feature that must be checked closely and that is the drilling of the holes. This frequently leaves the walls torn and scored. It is important that the holes be so drilled that there will be a smooth finish throughout their length.

There is a question as to whether the radii for the rounded edges should be shown in detail on the drawings and whether the finish of the walls of drilled holes should be specified in detail. I have been told that in some foreign countries the drawings do not specify these details, but that the shop practice covers them thoroughly and adequately. This seems to be a reasonable practice.

We have also to contend with the fact that the rush of repairs frequently causes the avoidance of what may appear to be unnecessary work. I recall a time when I was in charge of a change in the process of heat treating steel

springs. The method was considerably slower than the one formerly used and I was continually urged to rush this or that batch of springs. I held to the well laid out plans, however, with the final result that the springs frequently stayed out for six or seven years, instead of coming back at short intervals.

The same thing is true with rods. Those which are properly finished will give a long life in service and the railroad will benefit to an enormous extent. The loss from poorly machined rods is very great and it can be cut drastically by attention to the radii of finished edges, the elimination of tool marks and score marks, and perhaps slight changes in design. The designer must bear in mind that he must eliminate possibilities of a part failing because of tool marks or unfinished edges, etc., by designing the parts as plain and simple as possible. The shop man can finish almost any shape desired, but it is not always desirable to have him do this, if it makes it possible for a thoughtless mechanic to provide causes of failure because of poor finish. Odd shapes require special care and should be avoided as much as possible. The locomotive wants plain lines of strength, and if these are used the beauty and a long, useful life will be insured.

In conclusion, let me emphasize again two facts which I have tried to bring out in this article—the necessity for the proper finish of the edges of drilled holes and the design of the parts to avoid concentration of stresses.

Locomotive Cylinder Irons Compared

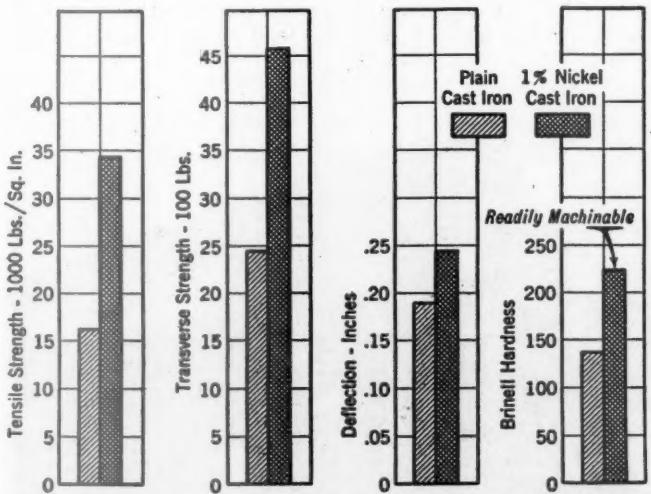
The recent production of a pair of locomotive cylinders weighing 10,000 lb. each has furnished some interesting information on the improvements obtainable from the use of small amounts of nickel in conjunction with a high grade base mixture which offers no difficulty of production in the grey iron foundry under ordinary production conditions.

In order to obtain mechanical-property data which would be more nearly comparable with the properties represented by the large slow-cooling castings, special test bars 4 in. in diameter by 18 in. long were cast in addition to the smaller arbitration type bars. In connection with the latter it should be noted that these were 1.50 in. in diameter instead of the 1.20 in. in diameter of the standard arbitration bar. The tests which furnished the data presented herewith were conducted in the Bayonne research laboratory of the International Nickel Company. The testing laboratory of the railroad in whose shops these castings were produced also conducted an investigation, the results of which are in substantial agreement with the present data. The object was to determine the relative tensile strength, transverse strength, Brinell hardness and microstructure in the 1½-in. and 4-in. sections of two types of locomotive cylinder iron as shown below:

	Plain iron	Nickel cast iron
Total carbon	3.40-3.50	2.90-3.00
Silicon	1.40-1.60	.90-1.00
Manganese	.40-.50	.85-.95
Nickel	1.00-1.25
Charge, per cent		
Pig iron	25	15
Car-wheel scrap	40	15
Foundry returns	35	15
Steel	..	70

The following results were secured from the tests:

1. An improvement of 100 per cent in the tensile strengths of test bars taken from the center of 4-in. rounds was found to exist in nickel cast iron as compared with the conventional grey iron. It is interesting



Physical properties of plain and nickel cast irons suitable for locomotive cylinders

to note that an improvement of this order in the heavy section is compared with an improvement of but 50 per cent in 1½-in. test bars representing the same two materials.

2. Transverse tests on 1.25-in. diameter bars machined from the center of the 4-in. rounds substantiated

the improvement in strength referred to in No. 1. As tested on 12-in. centers, the nickel cast iron showed an improvement in transverse strength of approximately 90 per cent with a 28 per cent improvement in deflection.

3. The Brinell hardness in the center of the 4-in. round-plain cast iron was found to be 137 as compared with 228 for the nickel cast iron as determined in the same relative position.

4. The microstructure of the plain iron in the 1½-in. section was found to be ferritopearlitic, as compared with a very fine pearlitic-sorbitic matrix in the nickel cast iron examined in the same section.

The core of the 4-in. diameter bar in plain cast iron displayed a coarse ferritopearlitic matrix containing free ferrite, whereas the nickel cast iron in the same section showed a very fine pearlite and some sorbite.

5. The fracture of the alloyed cast iron in the 1½-in. section was found to be mottled, but despite a Brinell hardness of 332 in this section these bars were machined without much difficulty. It should be noted that the fracture of this same material as observed in the 4-in. section was medium-grained and grey and that the Brinell hardness in this section was 228.

This difference in fracture is accounted for by the larger volume of metal and the correspondingly slower cooling rate in the heavier test bar and is more nearly representative of what might be expected in the casting itself.

New Haven Diesel Switchers

(Continued from page 528)

The field-shunt circuits serve a double purpose. By the selective operation of the proper field-shunting contacts, weight transfer between axles is compensated for during operation at high adhesion. In other words, the field of the motor on the leading axle of each truck is shunted, thereby reducing the tractive force on that axle approximately in proportion to the amount of weight relieved. This allows all four axles to operate at the same adhesion even though their loads are different, and thereby advantage is taken of the entire weight of the locomotive, and not the weight as limited to about four times the load on the lightest axle under severe weight-transfer conditions. Weight-transfer compensation is obtained by operation of a foot pedal at the engineer's position and is used under much the same conditions as sand. By its use the effective weight of the locomotive is increased about 10 per cent.

As a further aid to rapid switching, slip relays are installed which operate a buzzer at the engineer's position when slipping occurs, giving him instant warning that he has lost the tractive force on one truck or both.

Auxiliaries

The main generator also furnishes power for all auxiliaries. At idling speed, 300 r.p.m. with the throttle in the off position, the main generator voltage is regulated at 115 v. by a voltage-control relay. When the throttle is open, the generator continues to operate the compressor and radiator blower, but the battery charge is dropped and the battery furnishes power for control and lights.

The compressor is a high-speed, single-stage, water-cooled machine with a displacement of 100 cu. ft. per min. It is driven by a double-commutator motor for

operation at full displacement at 115 v. during idling, and at full displacement at 600 v. when the generator is furnishing traction power.

Provisions were made for heating the locomotives in cold weather from an external steam supply when the Diesel engine is shut down. Keeping the engine from freezing is always a troublesome problem during layovers. The New Haven switchers, therefore, were equipped with a 2-in. insulated steam line with standard hose and coupler head at each end, so that they can be connected either to yard steam supply or to a steam locomotive, and the engine jacket, radiators, piping, etc., kept warm.

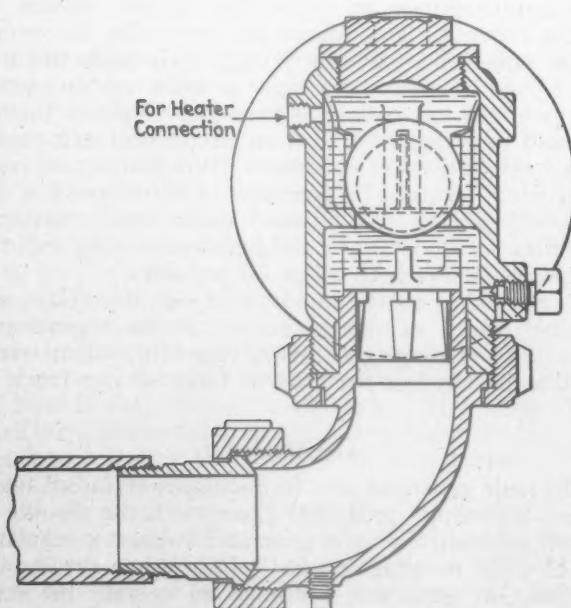
The generator is isolated from the engine compartment by a partition, the generator fan discharging on the engine side of this partition. Thus the generator draws cool air in over the control equipment and discharges it into the engine room, putting the engine room under pressure to assist in its ventilation. The air intake of the engine is taken almost directly at the louvers in the hood doors so as to provide the coolest air possible.

Up to the middle of October three locomotives had been delivered to the railroad and immediately prepared for and put into regular 24-hour service in New Haven. Preliminary plans call for the assignment of three locomotives in New Haven, two in Providence and five in Boston.

Improved Boiler Check Valve

A combination ball-and-stop boiler check valve, recently placed on the market by the Morris B. Brewster Co., Chicago, employs a stainless-steel ball in the upper or pressure cavity of the body for retaining boiler pressure therein to permit the removal of the stop check valve for reseating, when necessary, without blowing down the boiler.

The ball, being nearer to the source of pressure, takes

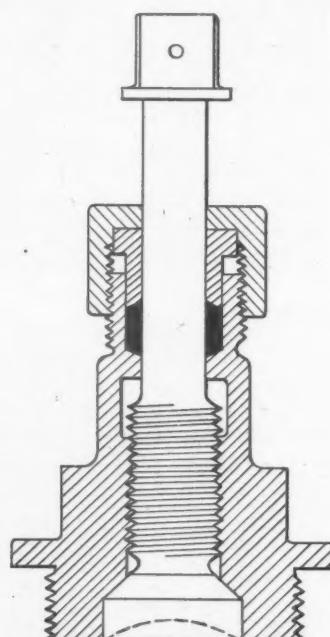


Brewster combination ball-and-stop boiler check valve

its seat when the flow of intake boiler feed water ceases, an instant prior to the stop check valve. The stop check valve, in turn, seats against the receding branch

pipe water as a cushion with a resultant reduction in pounding effect and frequency of reseating.

The ball rotates, when unseated during the intake of boiler feed water, in monel-metal guides cast integral with the upper cavity of the check body, and this rotary action maintains the ball in a scoured condition which assures dependable seating at all times. The lift of



Clamping screw for seating the ball when testing a feed pump

the stop check valve is governed by the length of the projections on its top surface which may be reduced to provide increased lift if necessary.

This boiler check is designed with either threaded spanner nut or bolted flange connections to the branch pipe and for either single-side or twin-top boiler applications for use with an injector or a boiler feed-pump system. When used with a boiler feed-pump system, a cap with a clamping screw is provided for seating the ball when a slip test of the feed pump is being made.



Canadian National 4-8-4 type locomotive

EDITORIALS

Attention Please!

With the completion of the December issue of the *Railway Mechanical Engineer* the final work on the index for the calendar year is begun. The index is mailed only to those who desire it. If you did not receive the 1935 index, please send us promptly your name and address for inclusion on the 1936 mailing list. A subscriber having requested the index for 1935 will receive it again this year without further attention.

Equipment Orders

The number of orders placed for cars and locomotives for domestic use during October was most gratifying, as was pointed out in the editorial on Car and Locomotive Orders in our November number. The record for the first 27 days of November, however, proved to be much better, two good sized orders being announced the day before Thanksgiving. Orders reported for the first 27 days of November included 193 locomotives, 2,550 freight cars, 42 passenger cars and six light-weight passenger trains with an aggregate of 20 body units. This brings the total orders for domestic use, for the first eleven months of 1936, except for the last few days of November, to 373 locomotives, 41,214 freight cars, 204 passenger cars and 10 light-weight passenger trains with an aggregate of 52 body units either partially or wholly articulated.

Equipment Ordered for Domestic Use

	Locomotives	Freight Cars	Passenger Cars
1925-9 (inc.), Average.....	981	78,854	1,980
1930	440	46,360	667
1931	176	10,880	11
1932	12	1,968	39
1933	42	1,685	6
1934	183*	24,611	388†
1935	83	18,699	63
1936 (to Nov. 27 only)	373	41,214	204‡

* 73 of these were electric locomotives for the Pennsylvania.

† 113 of these coaches were for the Erie and 50 for the New Haven.

‡ To this must be added 52 body units in 10 light weight articulated trains.

There were inquiries outstanding on November 27 for 72 locomotives, 11,031 freight cars and 36 passenger cars. There is, therefore, a possibility that before the end of the year total orders for locomotives and freight cars may equal or exceed those for the year 1930. Car loadings have continued to hold up well and general business conditions are such that it is quite likely that unless something unforeseen happens, the traffic for the year 1937 will greatly exceed that for the present year.

An Outstanding Performance

A passenger-train performance was recorded on the London & North Eastern Railway of England on August 27 which is both outstanding in character and illuminating in relation to the light-weight, high-speed trains which have been attracting so much attention in America. The performance was recorded on a regular run of the "Silver Jubilee" train operating between London and New Castle, a distance of 268.3 miles, on an overall schedule of 67.07 miles an hour with one intermediate stop. The run was made with the regular train of seven body units, articulated in two groups of two and one group of three units each, weighing 246.4 (short) tons, with a dynamometer car which brought the train weight up to 284.5 tons. The train was hauled by the "Silver Link," a streamline Pacific type locomotive, with a total weight, including tender, of 185.2 tons, bringing the entire weight of train and locomotive up to 469.7 tons.

On the opposite run on the same day a maximum speed of 113 miles an hour was recorded on a descending grade. During the performance under consideration, however, the top speed was limited to 90 miles an hour and all operating slowdowns were strictly observed to determine what reserve the locomotive might have on the schedule. The record of the run, presented in the *Railway Gazette* (London), deals with the non-stop portion from Kings Cross to Darlington, 232.3 miles, made on a schedule of 198 min., or 70.4 miles an hour. This was actually timed on the day in question at 194 min. 43 sec., or 71.48 miles an hour.

The trend of the road is essentially level, there being no significant difference in elevation between the two termini. There are, however, two major summits with ascending grades at the prevailing rate of 0.5 per cent for approximately eight miles and nine miles, respectively, with a number of lesser summits with similar grades two or three miles long. The remainder of the line is gently rolling or level.

Except for periods of acceleration at the beginning of the trip and following a number of operating slowdowns, the locomotive worked steadily at a cut-off of 18 per cent, including the ascent of the longer of the two hills, which was made without change of cut-off with a reduction of speed from 86½ miles an hour to 75 miles an hour in 11 miles, of which five ascended at the rate of 0.5 per cent and three 0.56 per cent. One of the remarkable features of the locomotive performance was the small drop in pressure between the boiler and the steam chest. During much of the time the locomotive was operating with full throttle the pressure drop was

limited to 5 lb., with occasional increases to 10, 15 and 20 lb. For an appreciable part of the run on the descending grades the locomotive was operated with the throttle partially closed.

The Silver Link is a three-cylinder locomotive carrying a boiler pressure of 250 lb. and developing a tractive force of 35,455 lb. on 80-in. drivers. It has a combined heating surface of 3,326 sq. ft. and a grate area of 41.25 sq. ft. Estimating the indicated horsepower capacity of the locomotive at high speeds conservatively, this train, as operated during the test, had a horsepower-weight ratio of slightly less than 5 hp. per (short) ton of combined locomotive and train weight and a ratio of five or better per ton when hauling the normal train.

The Denver Zephyr trains recently placed in service by the Chicago, Burlington & Quincy consist of ten body units, three of which are independent vehicles and seven of which are articulated in three groups of three, two and two units, respectively. The trains weigh 415½ tons each and are hauled by a two-unit Diesel-electric locomotive weighing 213 tons, a total of 628.5 tons. The 3,000 hp. of rated engine capacity provides a horsepower-weight ratio of 4.7 hp. per ton of combined train and locomotive weight.

This train operates on a schedule of 16 hours for 1,017 miles, an average, including ten intermediate stops, of 63.56 miles an hour. The character of the two runs is so different that direct comparisons are impossible. Both, however, have two characteristics in common. They require fast running, and their ability to maintain such schedules lies in a high horsepower-weight ratio, not primarily in the kind of motive power with which they are hauled.

Handle Small Tools Carefully

Experienced railway shop men generally appreciate that small cutting tools, such as milling cutters, reamers, taps, etc., with exposed cutting edges, must be handled carefully if the desired results in the way of smooth, accurate high-production work are to be obtained. In other words, the tools may be correctly designed and ground in the first place, but unless the cutting edges are guarded against subsequent damage throughout the entire period of shop and tool room handling, they are almost sure to become dulled, nicked, or broken with resultant inferior work, power wasted and time lost.

The unfortunate fact about cutting-tool efficiency is that it may be lost by momentary carelessness on the part of shop men, who, generally speaking, are good mechanics but who have allowed their vigilance to relax in a brief period of thoughtlessness, or just enough to permit tool damage to occur. The result is that all of their good work in being careful nine-tenths of the time is lost.

Many instances may be cited to show the way in which even a careful program for the handling of small

tools may be rendered largely ineffective by slighting a single detail. In one shop, for example, the tool foreman took a justifiable pride in his toolroom with its modern equipment and well-designed bins where cutting tools could be kept safely and in an orderly arrangement. He even went so far as to line the bins in the tap section with felt to protect the cutting edges of the tools. Much to the chagrin of the foreman who made a surprise check one day, he found taps stacked two and three deep in some of the bins! Needless to say, many were nicked. A further check in the shop showed numerous instances in which machinists tossed individual taps carelessly onto metal-top benches or into metal-lined tool boxes, etc.

Milling cutters of the larger size are usually handled fairly carefully owing to their weight, but small cutters and especially reamers frequently receive even less considerate treatment than taps. An article in the March *Railway Mechanical Engineer*, page 121, showed how one large midwestern railway shop used expensive ring gages to check the accuracy of reamer taper after grinding and also provided individual rubber protective boots for the larger frame reamers to avoid the possibility of damage while handling them about the shop. These boots consisted simply of scrap air-brake hose, cut to the proper length and provided with a wooden block in one end, held in place by three or four short nails. By the enforcement of rather rigid instructions requiring that reamers be kept in these protective boots at all times while out in the shop, except when actually being used for reaming holes, much more satisfactory reamer conditions and performance were attained.

One other fact regarding cutting-tool condition should be kept in mind; namely, that while the results of careless handling and resultant tool damage can be corrected by frequent grinding, cutting-tool life is thereby proportionately reduced. It is obviously good economy to exercise constantly the greatest care practicable in handling all types of cutting-tools used in railway shops.

Re-Winning Public Opinion

Alfred P. Sloan, Jr., president of the General Motors Corporation, gave a luncheon in New York on November 10 for Charles F. Kettering, in commemoration of the twenty-fifth anniversary of his invention of the electric self-starter for automobiles. During the course of the luncheon W. Averell Harriman, chairman of the Union Pacific, was called upon to speak for the railroads. Mr. Harriman naturally referred to the fact that early in the century the Union Pacific led the way in the application of the first internal combustion engine to a rail motor car. The first one of these cars, designed and built under the direction of W. R. McKeen, Jr., superintendent motive power of the Union Pacific, was placed in service April, 1905, and was described in the August, 1905, number of this publication, which was then known as the *American*

Engineer and Railroad Journal. A considerable number of these cars were built and placed in service.

Mr. Harriman went on to say: "We had our engineers abroad, studying all through the 20's the progress of the Diesel engine, but we did not feel that it was reliable enough or the economies justified the expense of experimentation, until we realized that public opinion was at stake and there was not any amount of money that we could not afford to spend to regain that."

There is no doubt but what the dramatic introduction of the streamlined trains has been a tremendous factor in attracting favorable public attention to the railroads. The public has regarded this innovation as evidence that the railroads still have a lot of fight in them and are determined to regain passenger traffic which was lost to their competitors. Passenger trains, whether streamlined or not, have been speeded up throughout the country and an increasing amount of attention has been given to making all trains more comfortable and convenient.

Mr. Harriman's final point, however, was a bit unusual and drives home a truth that we have systematically tried to emphasize in these columns, and that is that mechanical department employees, although they do not normally come in intimate contact with the traveling public, have an important responsibility in establishing better relations with the public. "Now it would seem rather odd when we are thinking about engineering," said Mr. Harriman, "I am talking about public opinion, but I think it would be a darned good thing if you engineers would put your minds to work on the job for industry to rewin public opinion."

The public is greatly and favorably impressed with the improvements that have been made in railway equipment and in the speeding up of the services. It will not be content, however, unless the job is fully and well done. A public which is shown all sorts of little courtesies by those who serve it in various capacities will not be satisfied with a few first-class trains, which are fitted with the latest conveniences and are decorated in an attractive manner. A favorable public opinion is vital to the railroads and its continuance can only be insured when the railroads extend the best of services and courtesies to the passengers on all trains, as well as to shippers generally. The mechanical department, because it designs and maintains the equipment, has a large responsibility in this effort.

NEW BOOKS

HANDBOOK OF ENGINEERING FUNDAMENTALS. Prepared by a staff of specialists under the editorship of Ovid W. Eshbach. Published by John Wiley & Sons, Inc., New York. 1,081 pages, 5½ in. by 8½ in., illustrated. Price, \$5.

The "Eshbach" handbook is the first volume in a proposed new Wiley Engineering Handbook Series.

It has been prepared for the purpose of embodying in a single volume those fundamental laws and theories of science which are basic to engineering practice and is essentially a summary of the principles of mathematics, physics and chemistry, the properties and uses of engineering materials, the mechanics of solids and fluids and the commonly used mathematical and physical tables, to which has been added a discussion of the elementary legal aspects of contractual relations with which all engineers should be familiar. The thirteen sections of the book cover Mathematical and Physical Tables; Mathematics; Physical Units and Standards; Theoretical Mechanics; Mechanics of Materials; Mechanics of Fluids; Engineering Thermodynamics; Electricity and Magnetism; Radiation and Light Acoustics, and Meteorology; Chemistry; Metallic Materials; Non-Metallic Materials, and Contracts.

KENT'S MECHANICAL ENGINEERS' HANDBOOK—POWER.

Published by John Wiley & Sons, Inc., New York. 1,254 pages, illustrated; 5½ in. by 8½ in. Price, \$5.

Kent's Handbook, in two volumes, of which "Power" is the first, is the second of the revised Wiley Engineering Handbook Series. The second volume, "Design and Shop Practice," will not appear until next spring. "Power" deals with the entire field of power and its application. It is divided into 17 sections. Section I, Air, includes not only a description of the properties of air, but also a discussion of the flow of air and a full treatment of air-compression, including fans and blowers. Section II, Water, covers the fundamentals of hydraulics. Section III, Heat, treats of the measurement of heat, heat transmission, evaporators and evaporation, dryers and drying, heat insulation and thermodynamics. A section on Combustion and Fuels follows. Section V gives information concerning steam, with extensive data as to its properties, steam piping and steam valves. Section VI applies these principles of the action of steam to the steam boiler, describing the various types of steam boilers, their performance, construction, etc., as well as superheaters, economizers and air heaters, moisture in steam, feedwater for steam boilers, boiler furnaces, and chimneys and draft. Section VII discusses the Steam Engine, while Section VIII covers the types, performance, etc., of the steam turbine. Section IX deals with Condensing and Cooling Equipment, and Section X with Refrigeration and Ice Making. Section XI presents a summary of the essential information in the field of Heating, Ventilating and Air-Conditioning. Internal Combustion Engines, including Diesel, gas and gasoline engines, are given much space in Section XII and Gas Producers in Section XIII. The needs of the mechanical engineer in railroad engineering, automotive vehicles and aeronautics are covered in Section XIV. Section XV summarizes the fundamentals of Electric Power. Power Test Codes are discussed in Section XVI and Section XVII contains mathematical tables of importance to the mechanical engineer.

THE READER'S PAGE

No Grouchy Railroad Employees?

To THE EDITOR:

I have been on the look-out for a long time for something I can disagree with, or at least question in the columns of the *Railway Mechanical Engineer*—not for any special reason, but perhaps because I believe it is impossible for any publication always to be 100 per cent.

I think I have found it at last. On page 399 of your September number, your otherwise very interesting and timely editorial states that one is constantly confronted with criticisms of grouchy railroad employees. Surely you have been referring to the notes you made years ago in your travels around the country, and I just want to give you an opportunity to correct your statement or bring on some proof. I am speaking for the Canadian National Railway and believe such a condition does not exist on this railroad. Come on now, where are the gourches located?

HARRY WESTBROOK

(Cases of grouchy railroad employees are not hard to find, even in these days. It would be embarrassing to have to mention names and places. It is true that some railroads have gone a long way toward impressing their employees with the necessity for courtesy and friendliness. Experiences within recent months, however, and correspondence which is coming to our desk, indicate that many railroad employees are almost entirely lacking in an understanding of the importance of courtesy and friendliness in contacting with the traveling public.
—Editor.)

Carrying Scrap In the Storehouse

To THE EDITOR:

Since 1929 large numbers of cars have been retired. The majority of this equipment has been dismantled by contractors who sell back to the railroads whatever material they wish.

Generally the stores departments of the railroads furnish the contractors lists showing what items they want. The stores departments place this material in stock without knowing whether or not they are buying good material or scrap material. Then, when the mechanical department issues a requisition for some of it, in many cases it is found that, according to A. A. R. rules and specifications, the items furnished should be scrapped. Items such as truck springs, brake beams, couplers, cast-steel truck side frames and many others are either scrap or have to be repaired. The repairs to these items will cost more than it would cost to purchase them new from the manufacturer. Besides, there is the delay in getting out the cars, etc.

On the majority of the railroads you can see large piles of coupler knuckles purchased from this source. A good many of them should not have been purchased and would not have been had the proper gages been used before they were removed from the couplers. If the proper gaging and inspection were made when such materials are purchased, the railroads would not be carrying a lot of scrap material in stock.

W. H. SHIVER.

Take It On the Chin

To THE EDITOR:

Like many other roundhouse foremen, I have come to regard the *Railway Mechanical Engineer* as something to look forward to each month. The interesting letter, or article, by "Bill Brown" several years ago, brought the foreman's job very much to the front.

From time to time, we read articles in the magazine by supervisors; some lament the fate of the roundhouse foreman and set forth changed conditions, running through terminals, and a host of other reasons for the foreman's so-called hard times. Again, others give us a picture which shows up very much in contrast. They have time to attend to lodge work, and other social functions. Occasionally they enter the House of God.

Just what does the outsider, or perhaps the chief supervisor, think of these opposites. Frankly, were I a chief of motive power, looking over the pages of the *Railway Mechanical Engineer*, I would wonder whether or not some of these men were "whiners" and others "cheerful, hustling, good, common-sense foremen."

True it is that conditions have changed. The stage coach passed, giving way to the "iron horse." Before me, as I write, is a part of a sermon preached by a certain Divine about a century ago, calling down the wrath of the Almighty on those who rode the "smoke belching, roaring contraptions," as he called the steam engines of George Stephenson's day.

Progress was not stayed by such diatribes. Time marched on, and ever will. We foremen must accustom ourselves to the ever-changing conditions. The writer, after almost 30 years connection with the "iron horse," and its activities, looks back upon these years as a panorama of progress. A ranking officer once remarked, "we cannot put 50 year heads on 25 year old shoulders, it is experience that counts." True, and that experience has covered many fields with any foreman who has had the benefit of many years experience, as instance:

The great increase in size and hauling capacity of our locomotives. Streamlining, and also the Diesel and oil-electric engines. Improved methods of effecting repairs and modern types of machinery. The electric and oxy-acetylene methods of welding. Systematic methods of following up failures to determine the cause, with a view to education and avoiding repetition. Education on accident prevention, from which excellent results have been obtained on our railway systems. The shortening of hours of service, and general improved working conditions, not to mention a hundred and one laws, rules and regulations, all pointing in the direction of education, safety, and good railroading.

We foremen should endeavor to keep up to scratch. After all, it is our job and we are a cog in the wheel of the great system we serve.

The test of the man is the fight he makes
And the grit that he daily shows;
In the way that he stands on his feet and takes
Life's numerous biffs and blows.

A coward can laugh when there's nothing to fear
And everything goes like a song;
But it takes a man to stand up and cheer
When the whole blamed works goes wrong.

ANOTHER ROUNDHOUSE FOREMAN.

Gleanings from the Editor's Mail

The mails bring many interesting and pertinent comments to the Editor's desk during the course of a month. Here are a few that have strayed in during recent weeks.

Eliminate All Tool Marks

Since more attention has been given the proper machining of parts we have noticed longer life with better results. A campaign is being made to eliminate all tool marks from machined surfaces and, wherever possible, ground fits are being made.

Better Be on the Right Side

I have read wth interest most of Mr. Williams' articles and believe that the points he brings out are generally very well taken. I think that some of the consequences he points out are probably somewhat exaggerated. However, it is of course always better to be on the side of extreme carefulness rather than carelessness in finishing locomotive parts, and not leave tool marks which may later result in failures.

Tricks of the Trade

With seniority ranking in locomotive shops today, mechanics do not move around as in the days of boomer journeymen, who carried from shop to shop the latest ideas and methods. We apprentices are taught but one method per operation, and only from the old timers or some trade publication may we learn of the dozen different methods in use at other points and of the tricks and short cuts employed.

Hardly Scratched the Surface

The information furnished by Mr. Williams in his articles on Failures of Locomotive Parts is of great interest to all railroad men. However, he has hardly scratched the surface. We have been following the practices referred to by Mr. Williams for quite a while, and have even gone further, with the result we have avoided many failures of locomotive parts, which has naturally reduced the number of engine failures and delay to trains.

Links in a Chain

If I might say so, I should like to see kept out of the *Railway Mechanical Engineer* all such articles as those by correspondents dealing with whose department is of the greatest importance. I think such stuff very childish and in poor taste. Let us fully appreciate the importance of the other fellow's job—we are all links in the chain. Let us learn from each other, not knock each other.

Williams' Articles Thought-Provoking

Mr. Williams' articles have the one excellent feature of being thought-provoking. Smooth and bright finishes are naturally desirable, but the question comes as to the cost and practicability of obtaining them. It is one thing to point out that rough machining leads to failures, but it is another thing to figure out just how much you are warranted in spending in eliminating rough machining. Such a problem can only be answered by real research. That is the kind that is thorough and costs time and money. It seems to me that such work is well worth while and inasmuch as all railroads would benefit, it is a matter for considered action.

Heating Passenger Trains

The subject of steam heat on passenger trains needs to be dragged out into the open and treated rather mercilessly. How much steam is required to heat, let us say, a standard 12-section Pullman sleeping car, standing still in zero weather? At 60 miles per hour? At 80 miles per hour? What is the pressure drop from the locomotive to the rear car under the same conditions? This problem involves certain fundamentals which are not necessarily tied up with specialized equipment of a competitive character.

Can't Be Too Careful in Checking Up

The articles written by F. H. Williams are very interesting and show conclusively that unless we are pretty well versed in failures of this kind we should not pass judgment on the cause of the failure. As far as we are concerned, in the turning and finishing of tires, I believe the practice at the shops is proper. We carry out the writer's suggestion and forward the broken parts to the laboratory for proper examination by those who are well fitted to do this examining; in making reports of failures of this kind, it is very important that all details be covered.

Administrative Ability Does Count

I read the article, "So You'd Rather Be a Puritan?" and re-read the "Roundhouse Foreman's Daily Log," and found them very interesting. While I realize that a roundhouse foreman at times comes up against a set of conditions that is difficult to overcome, I think that the gentleman who wrote these articles must be better at writing for magazines than at handling a roundhouse. A good roundhouse man must possess, among other things, mechanical ability, mechanical experience, executive ability, and authority. If he had these, I don't believe there would be many occasions on which he would have to cope with as many obstacles as does the gentleman who wrote the "Roundhouse Foreman's Daily Log."

Tire Failures

I have read Mr. Williams' articles on Locomotive Failures with a good deal of interest. With the increased speed, tire failures have become more numerous and frequently no good reason has been in evidence as a cause of the failures. If better and smoother boring of the tires will have a tendency to guard against such failures, and I have good reason to believe it will, then a good deal has been accomplished by Mr. Williams' research. We have all learned in later years to appreciate the hazard of sharp corners and scratches on machined parts, and as we go along the fruits of better shop practices should register an improved service, which, after all, is what we are all striving for.

Suggestions for Walt Wyre

I get quite a kick out of the Walt Wyre stories and the discussions on the Reader's Page about the foreman.****Getting back to Walt Wyre, I believe not enough is being done in his stories relating to the primary causes of engine and car failures and the proper methods of overcoming them. In other words, would it not be a good idea for him to write his stories so as to be most instructive to the younger railroader, by giving him the benefit of experience? I read an article about a throttle which leaked badly after being ground in. This operation was repeated several times without stopping the steam leak. Eventually it was found that the throttle box had been cast thin on one side and that expansion caused it to warp, resulting in the leakage. I like to read such articles because they are instructive.

IN THE BACK SHOP AND ENGINETHOUSE

Quantity Production of Piston Packing Rings

The Dunbar type of sectional packing ring is used generally for locomotive cylinder packing on the New York Central System and the production of these rings has been concentrated at the West Albany, N. Y., shop.

Description of the Ring

Fig. 1 shows the details of the Dunbar type ring. It is a sectional ring consisting essentially of an outside ring rectangular, in cross section, an inside ring of L-shaped

In order to provide the lap joints of the different segments after the completed inside and outside rings have been machined, a section of the outside or plain (rectangular) ring $1\frac{7}{8}$ in. in length is cut off and riveted to a segment of the inside or L-ring so that when finally assembled this spacer makes it impossible to assemble the rings in such a manner that the joints in the inside and outside rings coincide.

Facilities for Producing Rings

Both the plain rings and the L-rings are produced from cast iron tubs on two vertical turret lathes.

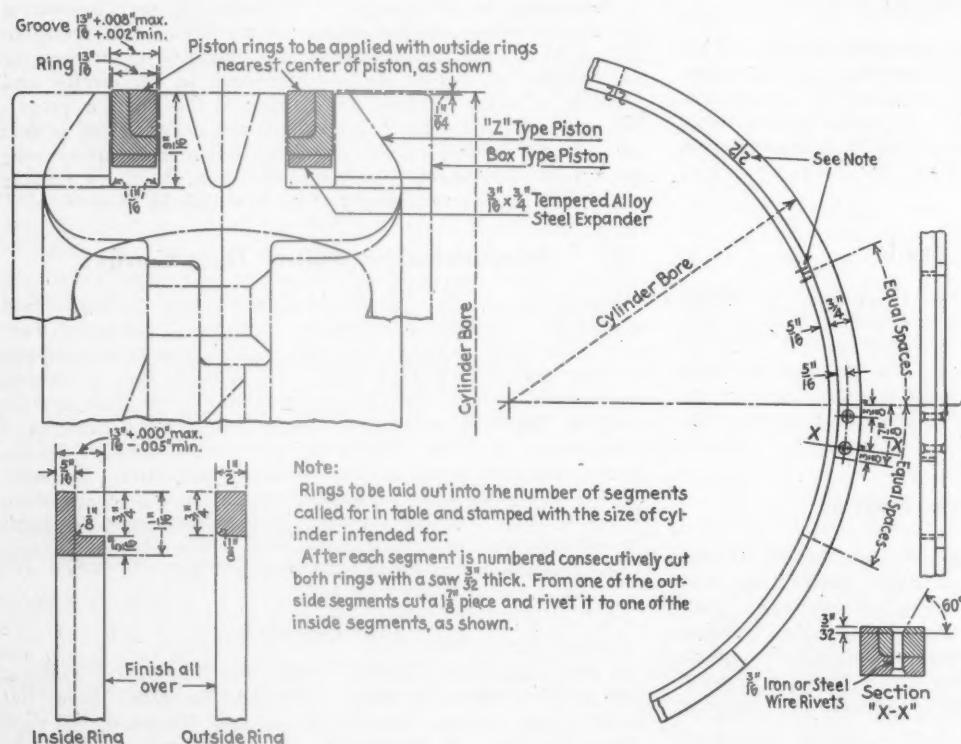


Fig. 1—Details of Dunbar type ring

The table referred to in the note above appears on the railroad company's original drawing and includes the dimensions of the various sizes of rings for all locomotives

cross-section and a tempered alloy-steel spring expander used in the grooves of the piston under the ring.

These rings are used for cylinder diameters varying from 19 in. to $40\frac{1}{2}$ in. As indicated in the drawing the rings are in segments, the number of segments varying as follows:

Cylinder diameter from 19 to $22\frac{1}{2}$ in.	6 segments
Cylinder diameter from 23 to 27 in.	7 segments
Cylinder diameter from 27 to $28\frac{1}{2}$ in.	8 segments
Cylinder diameter from 34 to $34\frac{1}{2}$ in.	9 segments
Cylinder diameter from 40 to $40\frac{1}{2}$ in.	10 segments

After the machining is completed the rings are sawed into segments by means of a power saw on a saw table equipped with a spacing device which enables the operator to saw the solid rings into the desired number of segments. From this location the segments pass on to an electric drill which is used to drill and countersink the holes for the rivets in the spacer section of the rings. Next a pneumatic squeezer is used to set the rivets, then a pneumatic hammer to drive the rivet heads home. A bench grinder is used to grind off the rivet heads

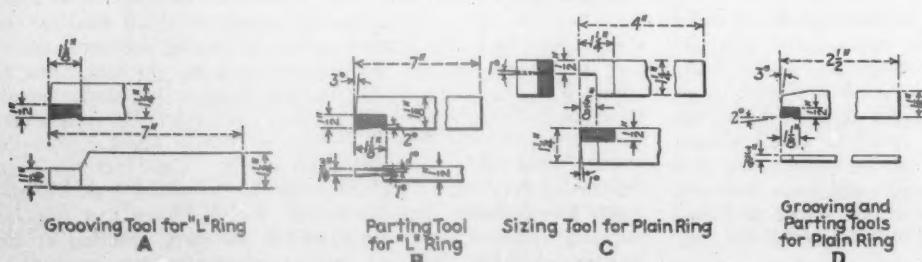
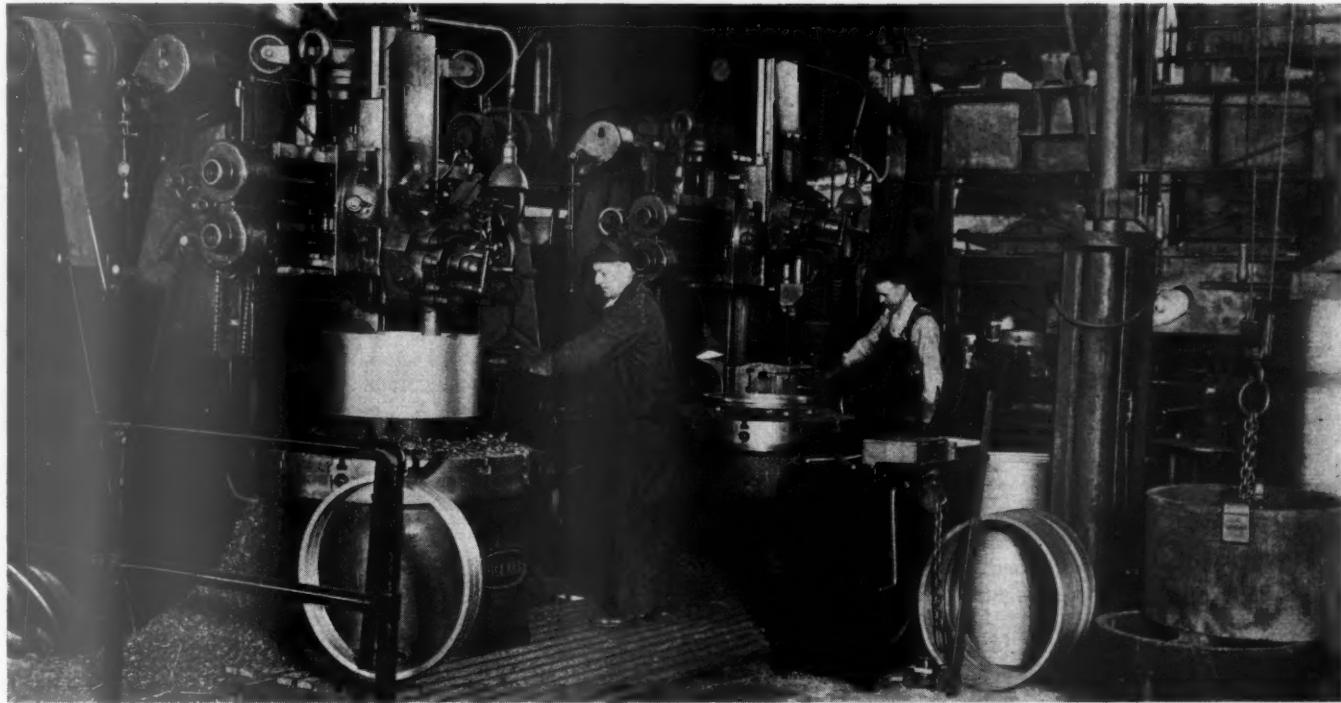


Fig. 2—Tool details



General view of the cylinder packing-ring production department at West Albany

flush with the surface of the ring. Next, the segments of a complete ring set are wired together, after which they are given an oil bath. They are then dried, wrapped in burlap, and tagged with the cylinder size, ready for shipment.

Production Methods

With the exception of the fact that different sizes of rings are cut up into varying numbers of segments, the production method is the same for all sizes of rings. In order to follow the operation through from start to finish, this article will deal with a ring set for a cylinder

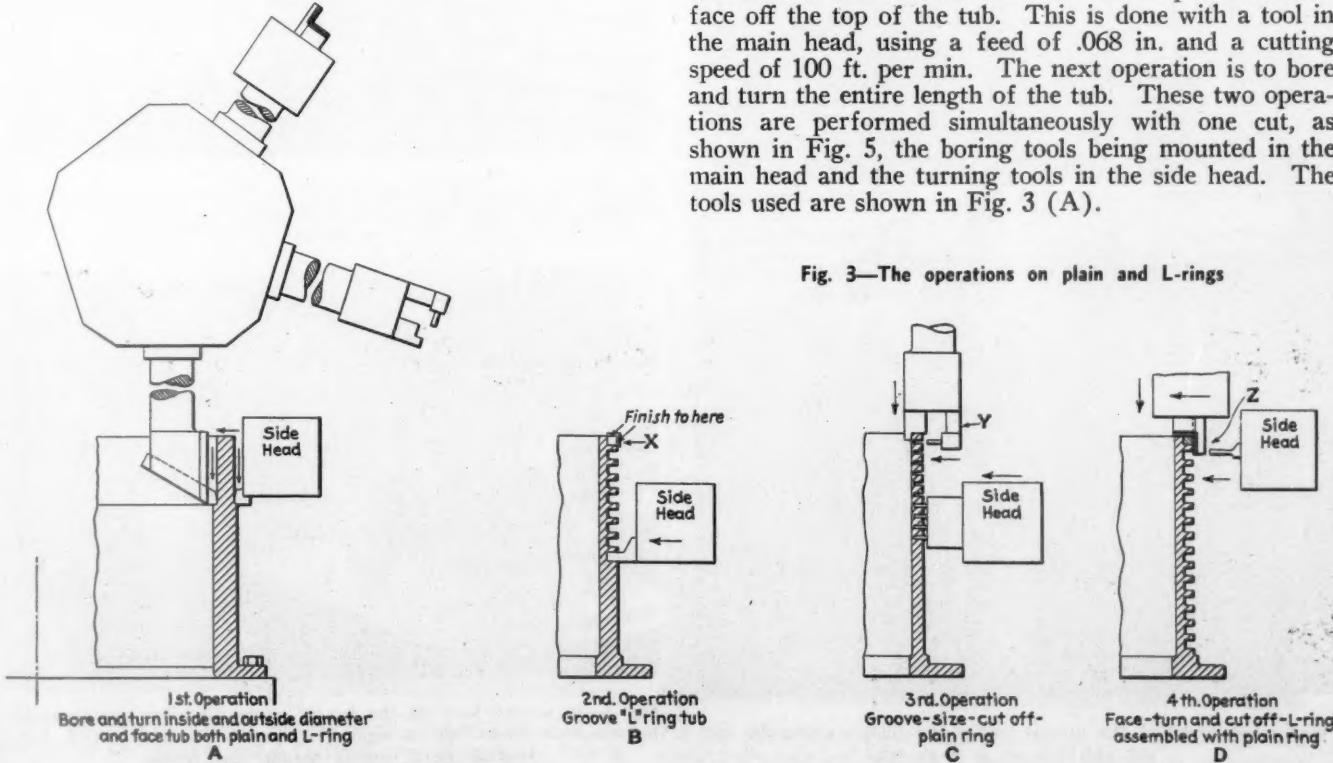
diameter of 28 in. Reference to Fig. 1 will indicate that the finished assembled ring is $1\frac{3}{16}$ in. by $1\frac{1}{16}$ in. in cross-section and that the inside and outside diameters of the plain and L-rings are as follows:

	L-rings	Plain rings
Finished outside diameter, in.	28	28
Finished inside diameter, in.	$25\frac{7}{16}$	$26\frac{1}{2}$
Rough packing tub outside diameter, in.	$28\frac{1}{2}$	$28\frac{1}{2}$
Rough packing tub inside diameter, in.	$25\frac{3}{16}$	26
Length of rough packing tub, in.	$16\frac{1}{4}$	17
Number of segments in ring	8	8
Number of rings produced from one tub	15	22

Machining Operations on Plain Rings

After the rough tub for the plain rings is set up on the vertical turret lathe table the first operation is to face off the top of the tub. This is done with a tool in the main head, using a feed of .068 in. and a cutting speed of 100 ft. per min. The next operation is to bore and turn the entire length of the tub. These two operations are performed simultaneously with one cut, as shown in Fig. 5, the boring tools being mounted in the main head and the turning tools in the side head. The tools used are shown in Fig. 3 (A).

Fig. 3—The operations on plain and L-rings



The gages shown in Fig. 4 are used to obtain correct inside and outside diameter of the tubs without the use of pin or snap gages. These gages are placed in the

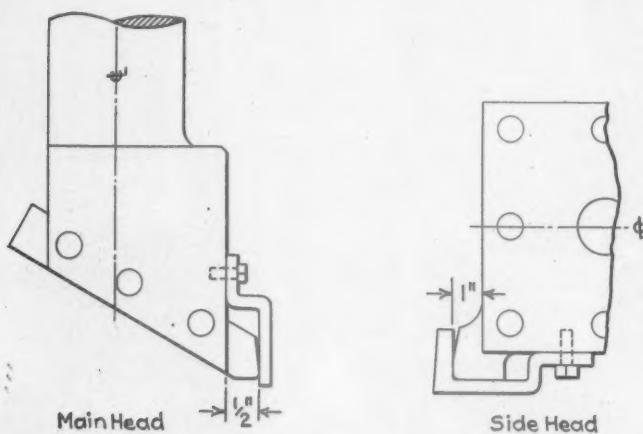


Fig. 4—Gages used for setting boring and turning tools

positions shown, the boring and turning tools placed against the gages and bolted fast.

The first tub of each diameter is bolted to the table and the correct inside diameter is obtained by using a pin gage. The correct outside diameter is obtained by using a snap gage. The reading on the feed-screw dial is then taken on both main and side heads and a record

made. On all subsequent tubs of this same size the correct inside and outside diameters are obtained by setting the heads to dial readings. Each time a tool

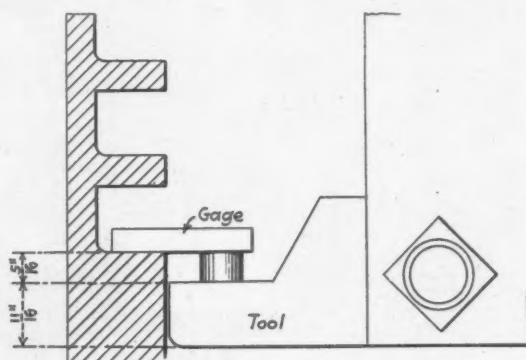


Fig. 6—Gage for setting the grooving tool for the L-rings

is removed for grinding it is relocated in the holder by using the gage shown in Fig. 4.

After the boring and turning operation is completed the next step is to cut the grooves in the tub for the 22 rings. This is done with a gang tool in the side head shown in Fig. 3 (C). The grooves are cut $\frac{1}{16}$ in. wide and to a depth of approximately $\frac{5}{8}$ in. In starting the cut for the first three rings the gang tool is set vertically

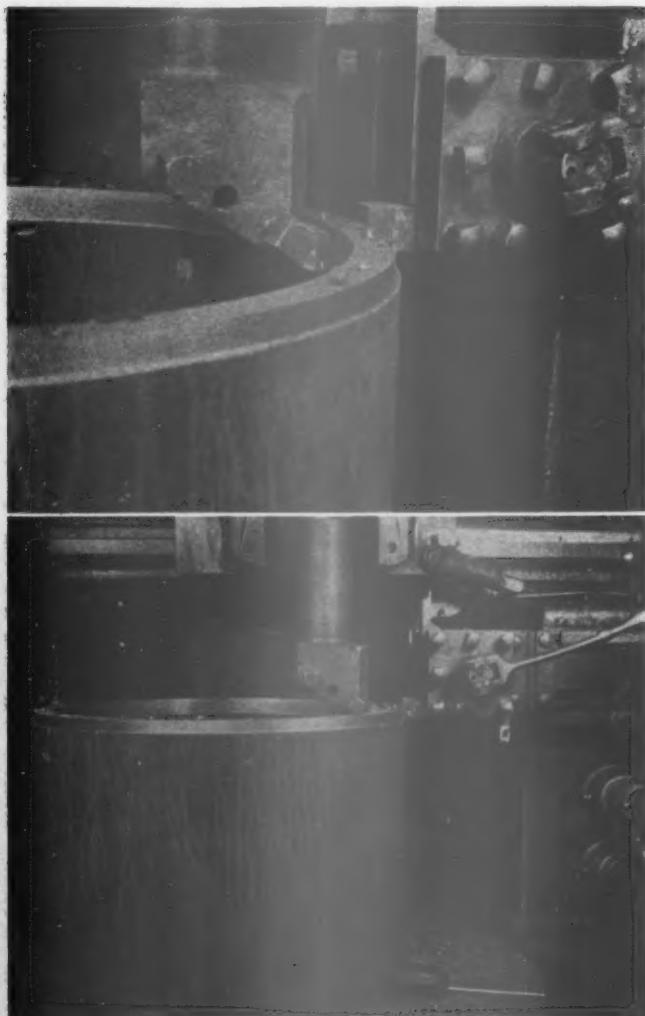


Fig. 5—Two views of the turning and boring tools starting the two-cut operation on a rough tub

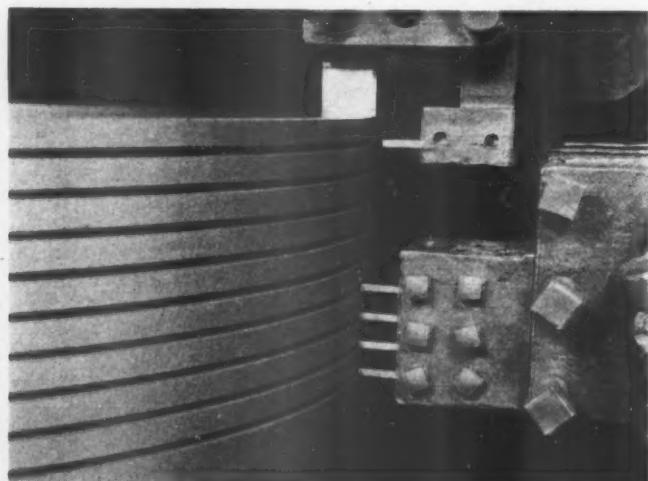


Fig. 7—The gang tool cutting grooves in the tub—The parting tool is shown at the top ready to be used, while the facing tool is seen in action

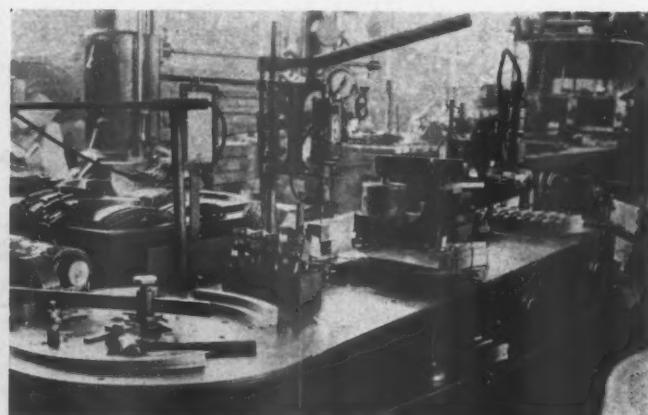


Fig. 8—A general view of the bench where the rings are prepared for assembly—From left to right: The segment saw, sensitive drill, riveting press, riveting hammer and grinder



Fig. 9—A close-up of the power saw showing the arrangement of the selector bar and stop pins for sawing rings accurately into varying numbers of segments, as desired

by lining up the bottom of the upper one of the four tools in the holder with the finished top surface of the tub. The remaining three tools are then fed into the work to cut three grooves. For the next four grooves the gang tool is set by the use of a gage similar to that shown in Fig. 6 by means of which the location of the top one of the four tools is established. This procedure is followed after each set of grooves is completed until all of the grooves for the 22 rings have been cut. After the first seven grooves have been cut and while the remainder of the grooves are being cut, the combination tool in the main head in Fig. 7 and at Y in Fig. 3 (C) is brought into use. This tool faces the top and inner face of the ring and also cuts a fillet on the inner edge of the ring. The parting tool of the combination is then fed into the groove and cuts off one ring.

With this combination by the time 22 grooves are cut 11 of the rings have been parted from the tub.

Machining Operations on L-Rings

After the rough tub for the L-rings is set up on the table of the vertical turret lathe, the first operation is to face off the top of the tub. The tools used for this operation are set up in the main head. A feed of .068 in. and a cutting speed of 100 ft. per min. are used for this operation. The next operation is to bore and turn the full length of the tub. These two operations are performed simultaneously with a boring tool in the main head and a turning tool in the side head, as shown in Fig. 3 (A). The gages for setting the tools are shown in

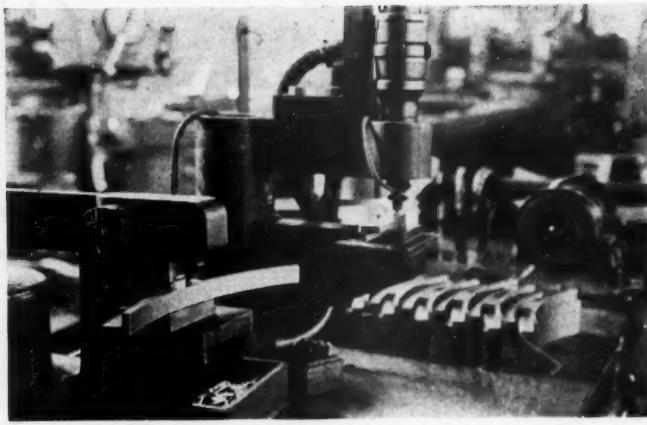


Fig. 11—The rivets are pressed in with the pneumatic press in the foreground and riveted over with the hammer in the background—After riveting the heads are ground flush

Fig. 4. The feed on the boring and turning operation is .068 in. and the cutting speed 100 ft. per min. After the tub has been bored and turned the next operation is to cut the grooves for all of the 15 rings. The groove for the first ring is cut, with the tool shown in Fig. 2 (A), $\frac{1}{2}$ in. wide and $\frac{3}{4}$ in. deep, and the 14 successive grooves are cut in the tub $1\frac{1}{8}$ in. wide and $\frac{3}{4}$ in. deep. After the first groove has been cut at the top of the tub the gage shown in Fig. 6 is used to establish the position of the grooving tool for the next cut. This gage consists of a short bar with a button exactly $\frac{5}{16}$ in. (.3125) in height on the bar. The bar is laid on the bottom surface of the last groove cut and the tool in the side head tool post is run up until it touches the button on the gage.

After all the grooves for the 15 rings in the tub have been completed the operator working on the L-rings takes a plain ring and fits it to the top of the machined tub, as shown at X in Fig. 3 (B). This is a light driving fit.

The $\frac{5}{16}$ -in. parting tool shown at Z in Fig. 3 (D) in the side head and in Fig. 2 (B) is now run up to the under side of the top ring and pressure applied so that a light finishing cut is taken, then the cross-feed is engaged and the parting cut started.

The combination tool shown in the main head is now brought down to take a light finishing cut on top of the assembled ring, then fed in to take a light finishing cut on the outer diameter. (Note that the combination tool is turned to the left in the head so that, looking at the

(Continued on page 552)

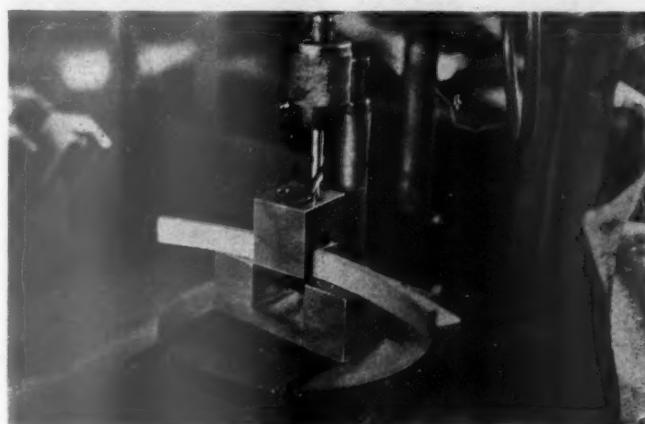


Fig. 10—In order to provide the lap joints a short section of the plain ring is cut off and riveted to the L-ring—Here is the drill jig that locates the rivet holes

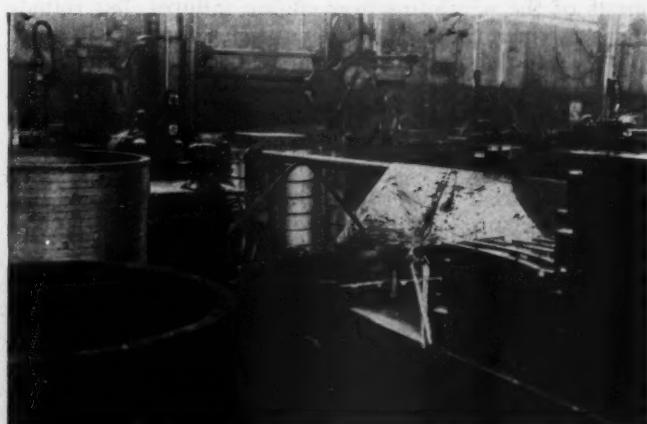


Fig. 12—After assembly the rings are dipped in a bath of lubricant, made up in sets and wrapped in burlap for shipment to the outfitting points on the system

All Out of Step

ENGINE failure! The most generally despised words in railroad language. Every one connected with a railroad from call boy to the president hates engine failures and well they might. Engine failures can cause more trouble on a railroad than squeaky shoes on a sound movie set. Passenger trains late, delayed freights, schedules disrupted—the whole carefully planned routine of railroading is disrupted when a locomotive suddenly and unexpectedly throws up its tail and quits.

Division superintendents are not baldheaded from thinking—they have chief clerks to do their thinking for them. They get that way as a result of engine failures. They pull their hair out; some of it comes roots and all until eventually there's none left to pull. After the hair is gone they rub the bald spot. After a sustained epidemic of engine failures, a superintendent's head becomes as shiny as the turret top of a new automobile.

Dispatchers that beat their wives only do so when carefully arranged schedules are shot to pieces by an engine failure on the Limited. Master mechanics having most tractable dispositions have been known to show symptoms of maniacal tendencies such as breaking up the furniture and kicking harmless dogs during an epidemic of engine failures.

Fortunately, engine failures are the exception rather than the rule. If that were not true, there would be a lot of PWA projects building insane asylums for demented ex-railroad officials. Better power, better equipment, better methods, and last, but not least, better men on the railroads are some of the reasons why, in spite of faster schedules and heavier trains, engine failures are not as numerous as might be expected.

If it ever becomes necessary to build asylums for railroad officials afflicted with dementia praecox, as alienists in court call plain crazy, special padded apartments should be provided for roundhouse foremen.

Superintendents may pull their hair, dispatchers beat their wives, and master mechanics have violent outbursts of the wimwams over engine failures, but roundhouse foremen can indulge in no such luxuries. It's their job to see that locomotives are in condition to make trips and keep on making them without delays. The late chain letter fad—peace to its ashes—didn't originate in Denver, Colorado, as is credited. It started many moons ago by railroad officials wanting to know the why of engine failures. The roundhouse foreman is the last link in the chain. Like the caboose on the end of a freight train, he gets the hardest jolt.

The Plains Division of the S. P. & W. has a pretty good engine performance record now, but there was a time not long ago when it stood out like a sore thumb of a hitch hiker. H. H. Carter had been master mechanic on the division about a year then. Jim Evans, the roundhouse foreman, was already considered an old timer at Plainville, having been on the job four or five years. Hard luck and Bill Walker hit Plainville at about the same time. It was Walker's first job as a general fore-



"What you got on your mind?" Evans finally asked

I've got plen

But Bill

by
Walt Wyre



I've got plenty. Sit down; I want to talk to you"

man. It came very near to being the last job he held.

Walker had put in most of his time in a supervisory capacity as a working foreman at an intermediate division point before coming to Plainville and it took some time to get the hurry-up idea out of his head.

WALKER put on his rush act at the drop-pit first. Morgan and Jenkins with their helpers were getting ready to put up the drivers on the 5091. Morgan was checking the fit of the newly bored right main driving-box brass.

The general foreman, watching the machinist, began to get fidgety. "Anything wrong with it?" Walker asked.

"Seems to fit a little too soon. Believe I'd better send it back to the machine shop and have a light cut taken out of it," the machinist said.

"Well, if you think it'll have to have it, go ahead, but we want to get the engine out." Walker's voice showed the impatience he felt.

The boring mill had another job in it and it would be an hour or more before the operator could get to the driving-box. Morgan decided to take a chance.

"When you figuring on getting the engine out?" the foreman asked Jenkins.

"Oh, if we have good luck, we should get it out day after tomorrow."

"I noticed you didn't seem to be in much of a rush," Walker said somewhat irritably.

"Sometimes it doesn't pay to get in too big a hurry," the machinist said mildly.

"Well, things are going to have to speed up around here. I want this engine out tomorrow by five o'clock." The foreman turned and went to the office.

"The men here don't seem to be in much of a rush," Walker remarked to Evans.

Evans let his feet drop from the top of the desk. "Oh, they do pretty well. Pretty good bunch of men."

"Those two machinists at the drop-pit. What are their names? I've been watching them all morning. They are slower than relief workers."

"You mean Morgan and Jenkins? They're not so slow. If you check up on them day in and day out, you'll find that they turn out about as much work as any two machinists you'll find. Their work stands up, too." Evans reached for his plug of horseshoe and went to the roundhouse.

The 5091 was off the drop-pit next day and failed that night. They ran it east on a drag, twenty-eight miles east to be exact. The right main driving-box burnt up. Driving-box wedges being too tight contributed to the cause of the box running hot. The drag made a main line meet with the Limited. The passenger train lost an hour and fifty minutes. The superintendent of motive power being on the Limited didn't help matters any.

Walker pulled the two machinists out of service,

claiming that the nut splitters had deliberately laid down on the job because of his urging them to hurry the job up.

Evans swore fluently and fervently at losing his two best drop-pit machinists for ten days. Every man in the roundhouse knew the circumstances in the case. Somebody nicknamed the new general foreman "Wild-eyed" Walker.

ECHOES from the howl over the failure of the 5091 hadn't died away when the failure of the 5084 started it all over again.

Hines, a pipe fitter, was putting up an air pipe on the engine. The pipe didn't fit and Hines started to take it back to the shop to heat the pipe and change one of the bends.

"What you going to do with that pipe?" the general foreman asked.

"Shorten the bend so it'll fit," Hines replied.

"Jumping Jupiter!" the foreman ejaculated, "and you call yourself a pipe fitter! Get a long bar; I'll show you how to make it fit."

After much heaving and prying the pipe was lined so the union could be screwed up. "No wonder you fellows have a hatful of slips left not worked every evening," Walker said as he walked away brushing his hands.

"I guess old Wild-eyed got you told," the pipe fitter helper jibed.

"Yeah, and if he says much when that pipe breaks, I'll get him told!" the pipe fitter replied.

His guess was correct. The pipe did break. It withstood the strain and vibration two trips before snapping off at the union. The Limited lost an hour and fifteen minutes while temporary repairs were made by a garage mechanic.

The next failure couldn't really be charged to any one. It was one of those more or less unpreventable failures that will happen occasionally as long as man made machines operate. The whistle valve stuck open on the 2872.

Careful examination of the whistle valve failed to reveal the cause. No one was blamed directly for the failure but that didn't keep it from adding one more to a mounting list of engine failures. It didn't keep half the people of Middleton from writing to officials of the road complaining of the whistle blowing thirty minutes on Sunday morning when they were trying to sleep.

In the meantime, Jim Evans was having troubles of his own. The power was in bad shape and rapidly getting worse. Every day when five o'clock came there were piles of work slips, each slip representing jobs not done. Apparently the men were working harder than before, but results didn't show it. Engines were seldom finished when expected. Terminal delays became more frequent.

The atmosphere of the shop had changed, too. The men no longer joked and kidded during noon hour and in the washroom after quitting time. From eight to twelve and one to five they worked.

Seldom was a man seen loafing by a foreman, especially the general foreman. When he was around, the men worked with the nervous haste that spells havoc with good workmanship and efficiency. Walker was the most nervous of any. He jumped from one place to another like a hen on a hot griddle constantly urging mechanics to hurry up. One thing he hadn't learned was that the grapevine telegraph in a roundhouse is faster than any man can walk. As he went through

the house, the signal that meant "Old Wild-Eye is coming" was always ahead of him. Clock watchers and boss watchers accomplish little else and the day force at Plainville had developed into both. Even Evans was beginning to acquire a nervous and irritable disposition.

IN the meantime, engine failures steadily increased. Fourteen in thirty days was the score the first month. On top of that they ran over their allowance, mostly because of an extra amount of overtime. Jim Evans chewed up a dozen pencils and as many plugs of horse-shoe trying to explain satisfactorily why the overtime had increased. He was frowning over another effort to answer a letter when the first-trick engine inspector entered.

"How is the 5062?" Evans asked.

"Pounding like a bunch of boilermakers on piece work," the inspector replied. "Rod bushings are worn over the limit. The rear tank wheels came in with keelys on both boxes and the engineer reported piston packing down and the left injector not working."

"Hope the bell ringer works," Evans remarked.

"No, it needs adjusting. The bell goes round and round. I've got it reported."

The office phone interrupted the conversation. John Harris, the clerk, answered it. "Hello . . . Yes, he's right here. . . . Train delayer wants to talk to you. Sounds like he's got a cockle burr under his tail," Harris said.

Evans grunted and expectorated about a pint of tobacco juice. "Hello . . . Yes . . . What?"—Evans swallowed hard—"O.K., I'll send an engine out right away."

"What is it now?" Walker had come in the office while Evans was talking to the dispatcher.

"Engine failure. The 5074 broke a main axle between Middleton and Huntsville."

"Do much damage?" he asked weakly.

"Wouldn't be surprised. She was doing sixty-five at least when the axle broke. It's a wonder she didn't mess up the right of way for a couple of miles," Evans added as he went in search of the hostler.

The general foreman followed him out of the office. "Guess we'll have to use the 5062," Walker stated rather than asked.

"Yeah—or the goat. They're the only two engines hot," Evans replied.

"You get a couple of machinists lined up to go. I'll help the hostler get the 5062 turned and ready."

The general foreman stood first on one foot then on the other while the engine was taking water and oil. He stood by the switch motioning the hostler to come ahead while the helper looked to see if there was sufficient sand in the dome. He walked two miles in a circle around the locomotive while the engineer was oiling round getting ready to go.

NEXT morning there was a message lying on top of the morning mail on the desk. "More bad news, I guess," Walker said as he picked up the pink slip of paper.

Evans noticed that Walker's hand trembled when he picked up the message. As the general foreman read the typewritten message, his face flushed. A line of white edged the wrinkles on each side of his mouth. He swallowed as though he was trying to down a large, hard lump of something too dry to swallow.

"What is it?—another engine failure?" Evans asked.

Walker silently handed Evans the message: "Engine

5062 tied up by government inspector account of Federal defects at Sanford date. Will advise later." The message was signed H. H. C., the initials of the master mechanic."

"Well, I guess that'll just about be the last blow," Walker said. "On top of all the engine failures and delays we've had since I've been here, I can't expect anything else."

Evans opened his mouth to say something. Instead he shoved a hunk of horseshoe in his mouth and went to the roundhouse.

The general foreman slumped down at his desk looking as dejected as a ten-year-old boy that had lost his dog. All morning he stayed in the office nursing his grief and pitying himself. He had done his best, Walker told himself. The men were laying down on him. Evans wasn't cooperating. Every one was against him. No one could have done any better under the circumstances, he told himself bitterly. "And, by heaven, I'm going to tell them so!" Walker spoke the last half aloud.

"Did you say something, Mr. Walker?" the clerk asked.

"No,—yes—I did. Make a bulletin to all shop employees saying that there'll be a meeting in the machine shop at one o'clock and every employee must be present. Make enough copies and post them all over the place so that no one will miss seeing them. And tell Evans I want to see him in the office," he added.

Harris obeyed the last request first and went in search of the roundhouse foreman.

TENSE silence filled the little room as the two foremen faced each other, each waiting for the other to speak. Evans wondered just what it was all about; why he had been called back in the office and the door closed. Walker couldn't figure out just how to begin.

"What you got on your mind?" Evans finally asked.

"I've got plenty. Sit down; I want to talk to you."

"O. K., go ahead; it might do us both good."

Walker was nonplussed for the moment by Evans' reply. He nervously arranged and rearranged the papers on his desk. He cleared his throat two or three times. "Well, I guess you'll be glad that I'm leaving."

"Hope you take this run of hard luck with you," Evans replied evenly. "Where you going?"

"I don't know and don't much give a damn, but I hope it'll be some place where the men I'm working with will cooperate."

"Everybody out of step but Bill," Evans murmured.

"What?"

"Nothing; just happened to think of an old song."

"Well, I'm in no humor for songs. I just wanted to tell you that I'm leaving—by my own request. It's plain to see you've worked against me ever since I've been here. The men have been laying down on me, too, and I'm going to tell them so! I've called a meeting for one o'clock. I want you to be there. I came here hoping to make good, and I could have if you had worked with me," Walker said bitterly.

"Is that all?" Evans asked without raising his voice.

"Yes."

"The song I mentioned was something about everybody being out of step but one," Evans said as he left the office.

"It's so near noon, don't you think I'd better put one of these bulletins on the clock so the men will see it when they stamp out?" the clerk asked.

"Maybe it's too late anyway. Tear them up. Did

Evans bid on the general foreman's job when it was vacant?" Walker asked.

"I don't think so. He owns his home here and is pretty well satisfied where he is. He has had chances to go to better jobs but didn't like the idea of moving around. Everybody likes Evans," Harris added.

"Guess he wasn't trying to get my job after all. I thought maybe he was," Walker said, half to himself.

THE twelve o'clock whistle interrupted the conversation. The general foreman didn't go home to lunch. He was in the office when Evans returned at twelve-forty.

"Call the meeting off?" Evans asked.

"Too late to get the bulletins up. I may not have any meeting—just ease out and leave it with them."

"Good idea," Jim said.

"My leaving?"

"No, not having the meeting. Wouldn't do any good and might leave some sore spots."

"Why have I had so much trouble here? Goodness knows, I've tried hard enough."

"Maybe you've tried too hard."

"What do you mean?" the general foreman asked almost pleadingly.

"Well, you asked me; I'm going to tell you. Giving advice is about the most profitless thing a fellow ever did, but here goes.

"You have been so anxious to make good you've let your anxiety overcome your judgment. Nobody could keep pace with your ideas and you thought the men weren't doing anything. Men hate to be driven. When you took Jenkins and Morgan out of service, everybody knew it wasn't their fault the engine failed. That gave you the reputation of being unfair. Then constantly rushing the men, even when they were working at a fair rate. They decided that if they had to work like killing snakes to satisfy you they'd just make up for it when you weren't around." Evans reached for his plug of horseshoe.

"Maybe you're right, but it's too late to change it now. I'm sorry for what I said before noon. I'll just call that meeting this afternoon and tell the men, too."

"I wouldn't do that," Evans advised.

"What would you do?"

"Oh, if I felt like I had mistreated any one, like Jenkins and Morgan, for example, I'd tell them so. Then I'd take a few days off and start over. Talk to the master mechanic about it. Carter is nobody's fool."

FAILURES did not stop immediately, but conditions improved. In less than a year the dispatcher and his wife took a second honeymoon. A patch of fuzz was beginning to show on the superintendent's bald spot, and the master mechanic hadn't had a fit in months.

Walker did finally call a meeting of all the men. Their was deep feeling in his voice when he told them he hated to leave Plainville. There must have been an epidemic of colds; at any rate, most of the men found it necessary to blow their noses.

When Jim Evans, acting as spokesman for the men, presented Walker with a traveling bag, Evans stammered and stuttered like a bashful boy speaking a piece. He did manage to say that while every one hated to see Walker leave, they were glad he was getting a better job.

Walker must have had a cold, too, the way he blew his nose.

Quantity Production of Piston Packing Rings

(Continued from page 547)

machine from the front, the tool works behind the parting tool. The parting and facing are done simultaneously. The parting tool serves the dual purpose of finishing the bottom of the assembled rings with one cutting edge at the same time that it is parting them from the tub. The same procedure is followed in assembling, facing, turning and parting the remaining 14 rings. On the facing and turning operation a feed of .010 and a cutting speed of 100 ft. per. min. are used. On the parting operation a feed of .011 and a table speed of 48 ft. per min. are used.

Production is at the average rate of 90 plain rings and 45 L-rings each eight hours.

Keeping a Locomotive Shop Clean

"Cleanliness is next to Godliness" and both cleanliness and good order are highly stressed at the Denver, Colo., shops of the Chicago, Burlington & Quincy. Special racks used in keeping cylinder heads, binders, steam pipes, etc., off the floor are shown in the illustrations. One of these, which gives a general erecting shop view, shows in the foreground a special cylinder head rack made of two steel rails spaced 24 in. apart and having 27-in. vertical flue sections, spaced 10 in. on centers and welded to the bottom rails. All cylinder heads are kept in this rack where they occupy a minimum of floor space, present a neat appearance, and where the steam joint surfaces are protected from damage. Valve chamber heads are kept in the forward part of this rack.

In the background of the picture is shown a similar rack for locomotive binders in which the two steel rails, 30 ft. long, are spaced 22 in. on centers and supported 2 ft. above the floor level by means of short lengths of superheater pipes welded to cross sections resting on the floor and made of 10-in. steel channels. As in the

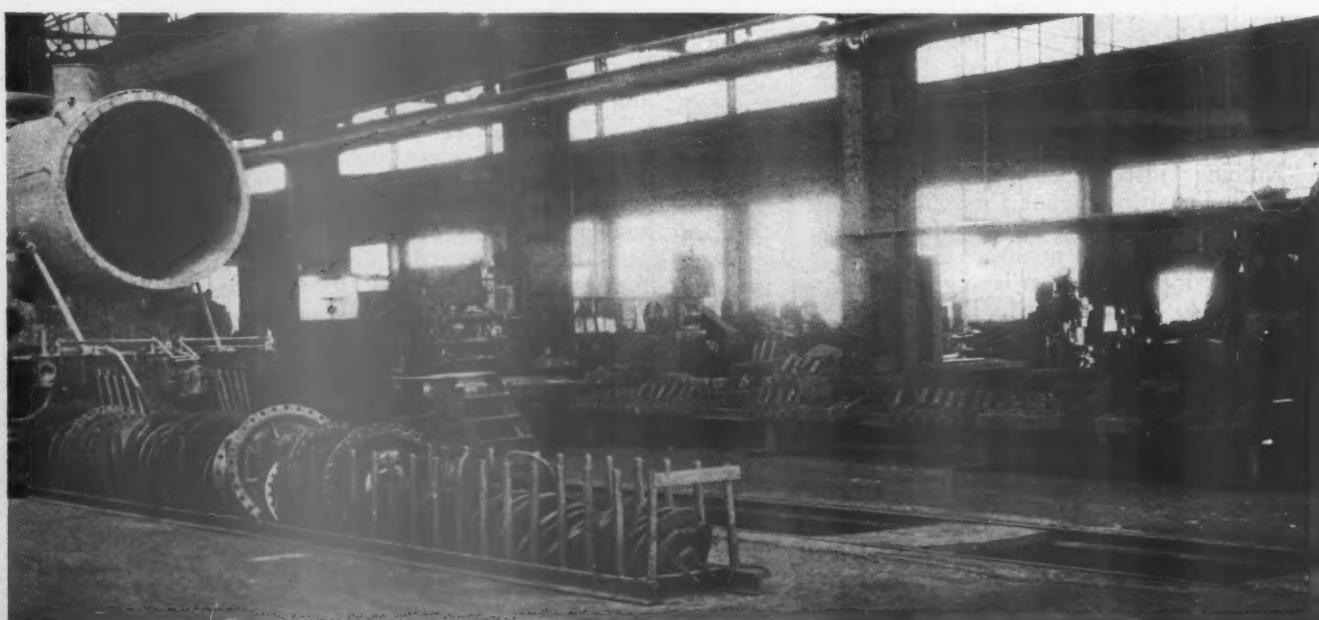
case of the cylinder head rack, this rack provides a convenient place where drawbars may be kept off the floor in the interests of safety and where they can be readily located by shop men for purposes of inspection, measurement, repair, etc.

Possibly the most awkward parts handled in railroad shops are locomotive steam pipes which are used in widely varying sizes and shapes. The special rack used at Denver shops for keeping these steam pipes in some kind of order and off the floor where they present a



Special cylinder head and binder racks used at the Denver, Colo., shops of the C. B. & Q.

constant hazard to passing shop men is shown in the illustration. It consists essentially of frame work 24 ft. long by 6 ft. high with the supporting tubular steel frame and legs 35 in. wide at the bottom. This frame work is made of boiler tubes and tubes jointed by welding, as shown in the illustration. The short sections of superheater flue at the top support two steel rails which are spaced 18 in. apart and tipped on their sides so that the rail flanges will extend under the steam pipe flanges and hold the steam pipes safely in a vertical position.



Welded tubular steel rack where steam pipes may be kept safely off the floor

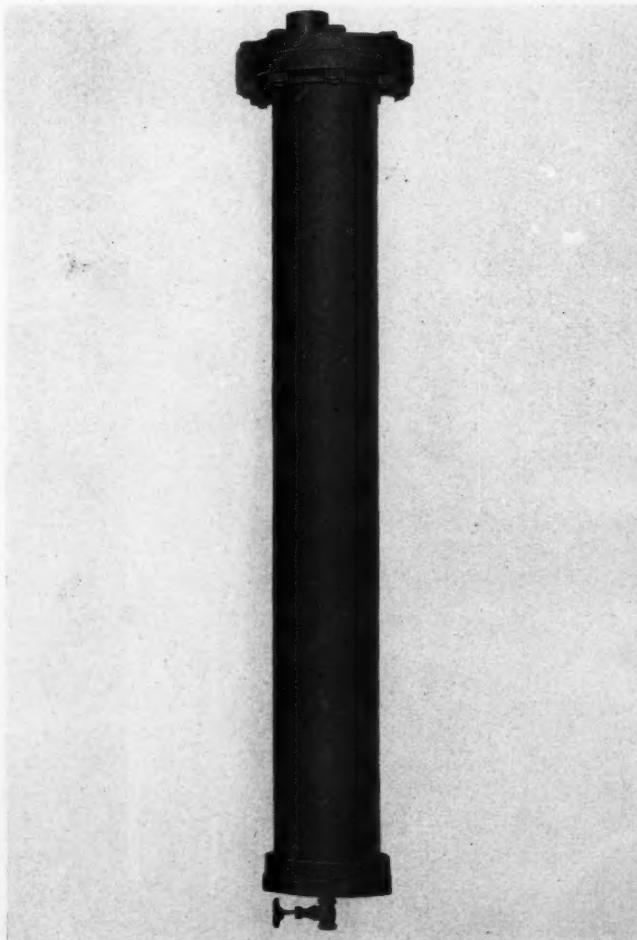
The top rails are held a fixed distance apart and with their bases vertical by means of several short spacer bars welded in place. Another advantage of this rack is that it prevents possible damage by the breaking of flanges which sometimes happens when steam pipes are left more or less carelessly lying around on the shop floor.

Oil and Water Condenser For Air Lines

A condenser designed for extra-heavy duty in removing oil and water from air lines has recently been placed on the market by the DeVilbiss Company, Toledo, Ohio. This condenser, designated as type HP-504-2, is designed with a baffle arrangement within the condenser and a pair of filter pads located in such a way that they can be removed and replaced without disconnecting the condenser from the air line.

Air inlet and outlet are both in the top cap which is fastened to the body of the condenser by means of a companion flange. This permits removal of the body of the condenser without disturbing the air line. The filter pads, which fit around the inlet tube and interior wall of the condenser tube, stop passage of any oil, water or dirt. The average life of these pads is said to be approximately three months. A drain valve on the bottom of the condenser permits drainage of accumulated condensation.

The Condenser is 4 ft. 8 in. long, has a tube diameter of 6 in., takes a 2-in. pipe thread on inlet and outlet tubes, and has a net weight of 140 lb.

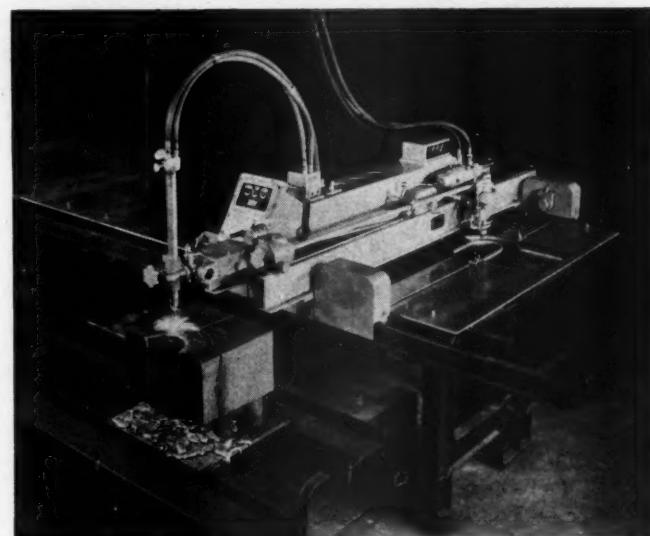


DeVilbiss condenser for removing oil and water from air lines

Oxweld Shape-Cutting Machine

The Linde Air Products Company, New York, recently introduced the Oxweld type CM-12 shape-cutting machine which is designed to increase the accuracy and range of flame-cutting. The flexibility of this machine is such that any shape, from the simplest to the most complicated, can be flame cut either automatically with templets or guided by hand. The immediate transfer of motion from one end of the machine to the other is an important factor in assuring precision in all cutting operations.

In addition to cutting shapes of all description, the machine will cut straight lines automatically in any direction and at any bevel. Cuts as long as 144 in. are possible and an important feature lies in the fact that straight-line cuts can be made at any desired angle in the horizontal plane. A special circle-cutting attachment is also provided, thus enabling the automatic production of circles from 2 in to 24 in. in radius. Still another fea-



Oxweld CM-12 shape-cutting machine

ture is that of multiple cutting. The apparatus is designed to carry from two to five blowpipes which can perform multiple cutting operations under all the conditions possible with a single blowpipe.

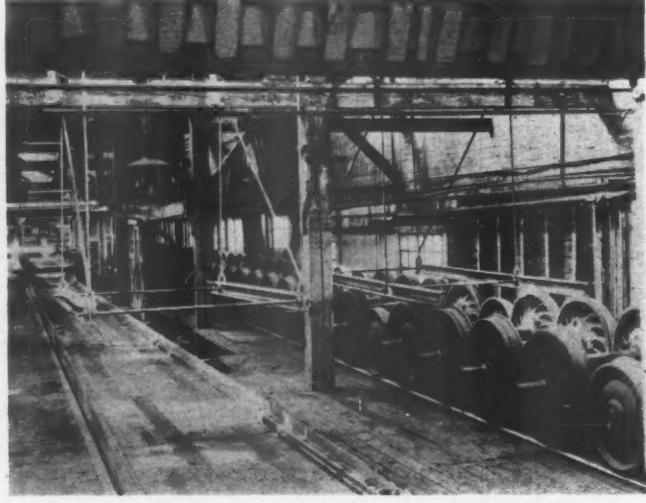
The features of design and construction which make possible the accomplishments of this shape-cutting machine typify the trend in modern machine development. Alloys have been utilized to establish an ideal strength-weight ratio combined with the necessary stability and rigidity of construction. The vital working parts are completely inclosed to insure correct lubrication and freedom from maintenance. The motor is rated at $\frac{1}{3}$ hp. and is more powerful than on any other shape-cutting machine in this class. The speed range of the unit is from $1\frac{1}{2}$ to 75 in. per min. All important controls have been duplicated so that operation is possible from either blowpipe or tracing position.

The blowpipes used have been constructed to give greater flame stability and increased economies in cutting. Material up to 12 in. in thickness can be handled; for heavier cuts a special blowpipe is available. The sensitive tracing mechanism, accurate scale calibrations and freedom from friction and vibration make precision cuts a routine accomplishment.

With the Car Foremen and Inspectors



Yard crane removing wheels from the elevated track



Incoming and outgoing tracks with retarders in place

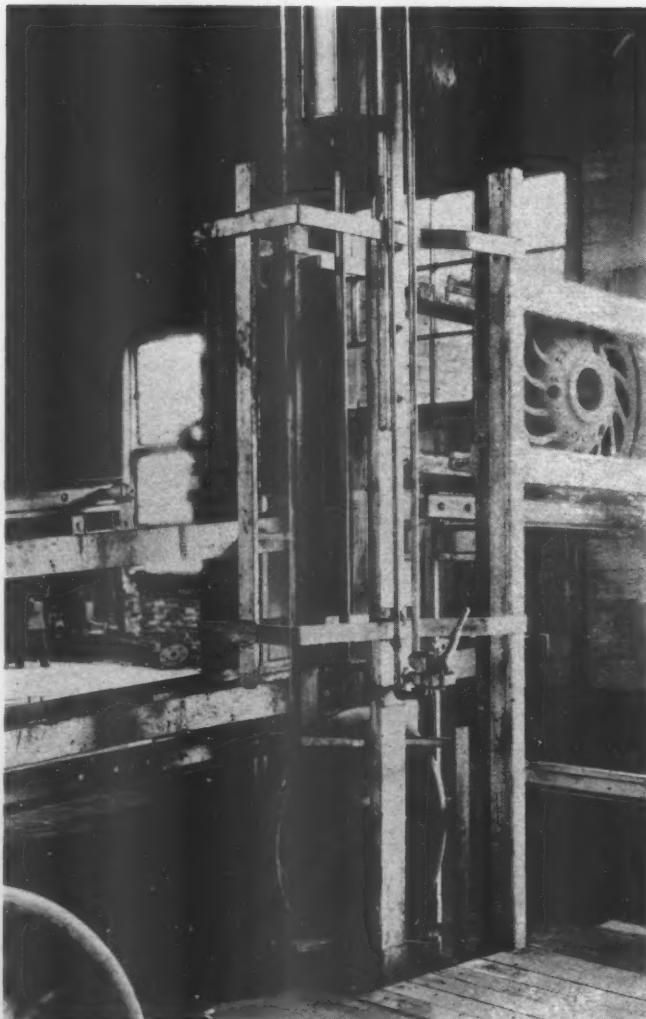
Wheel Repairs on the Canadian National*

Wheel repairs at the Point St. Charles shops of the Canadian National are now being made in a renovated shop equipped with facilities which permit the continuous movement of wheels during repair operations and which eliminates unnecessary handling and rerouting of wheels and axles. The incoming and outgoing tracks to and from the wheel shop parallel each other on an elevated structure supported 9 ft. above the wheel shop proper. This structure extends into the wheel yard a sufficient distance to enable the yard crane to place wheels on the incoming track and to remove repaired wheels from the outgoing track.

The incoming track is 350 ft. long, is inclined 6 in. in its entire length, and holds 130 pairs of wheels. Retarders are hung at convenient points along the track to control the speed of the wheels as they move to the end of the track which extends to a point over and just in front of the pressoff machine. The wheels are lowered into the press by an electric hoist. The outgoing track, to which wheels are elevated by means of an escalator, is 220 ft. long and holds 80 pairs of wheels. It is also equipped with retarders to control the speed of the wheels as they roll toward the storage yard.

Other handling equipment in the shop includes chutes for handling new and scrap wheels, and an inclined track for loading scrap axles. New wheels delivered to the shop are rolled down a chute made of used rails. This chute is 50 ft. long, has an adjustable exit, and terminates near the wheel storage and boring mills. The speed of the wheels rolling down the chute is controlled by a retarder. The handling of scrap wheels is accomplished by a similar chute, but the wheels must be elevated from the shop floor to the chute so that they can roll down an incline to a loading car. The wheels are raised from the shop floor to the chute by an air-operated elevator.

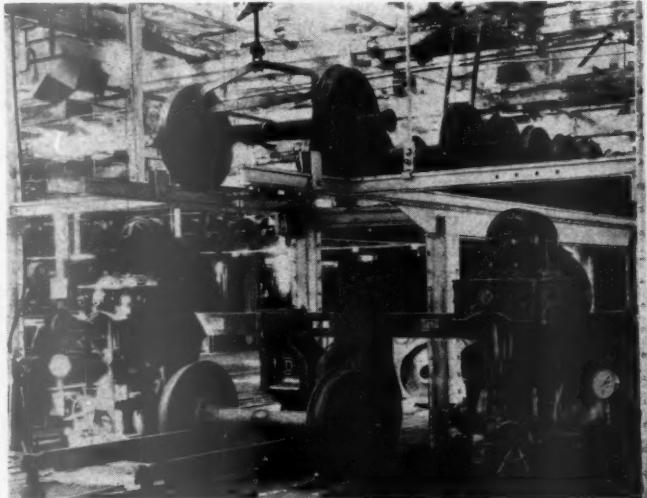
* Based on an article which appeared in the October issue of the Canadian National Railways Magazine.



Elevator for raising scrap wheels from floor to discharge chute

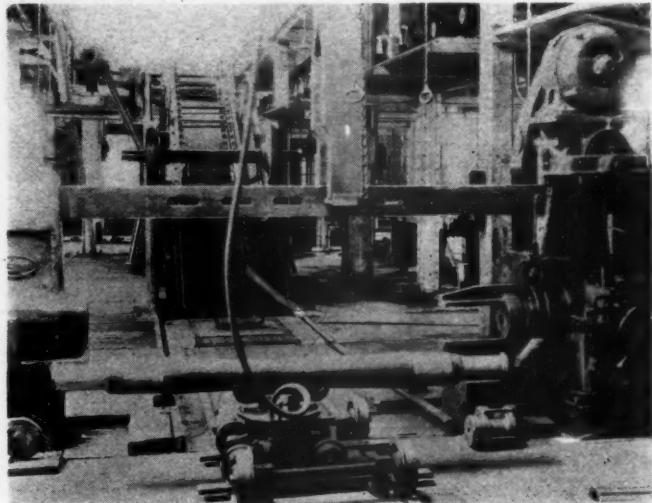
ated cage fitted with an unloading cam which pushes the wheel from the cage to the chute. Scrap axles are rolled from the shop to a loading car on an inclined track 2 ft. high.

If a pair of wheels enter the shop marked "scrap wheels and scrap axle," they are lowered into the press and the wheels are removed and raised to the scrap wheel chute to be rolled to the loading car. The scrap axle is rolled to the car siding on the inclined track.

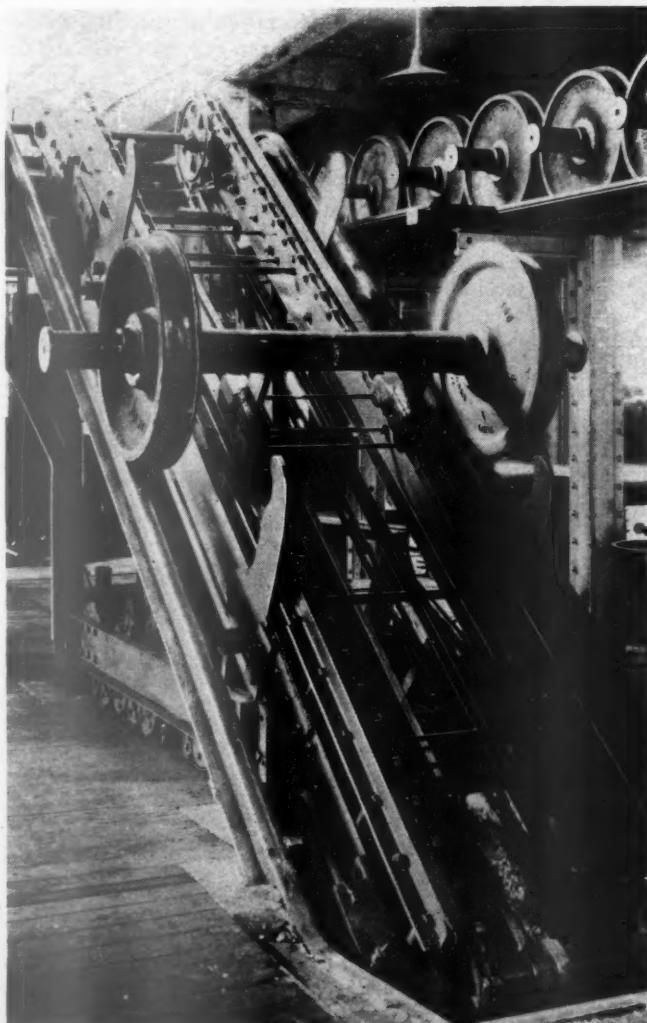


Incoming wheels over the press rod for dismounting

If a pair of wheels enter the shop with scrap wheels but with a good axle, they are lowered to the press, the wheels are removed and the axle is placed on a rack running between the axle lathes. The wheel seats and journals are turned and the axle is then placed on a rack down which it rolls to the mounting press machine and the boring mills. Wheel seat sizes are taken, wheels bored and applied, and the mounted wheels run through the press to the escalator and outgoing track.



Mounting press and yoke for removing misfit wheels



Escalator from shop floor to overhead outgoing track

If a third pair of wheels enter the shop with cut journals only, they are lowered from the incoming track, passed on to the journal lathes, and from there to the escalator to follow the preceding pair. At no point does one operation interfere with another, and since each operation follows in correct sequence there is no back-tracking.

The demounting press is of the double-end type and is used for stripping only. The wheels are lowered from the incoming track onto two rails 8 ft. long, fulcrumed at the end nearest the press, and operated at the other end by two air jacks. When the end of the rails are raised the wheels run into the press on their axles. In the case of wheels with cut journals, these rails are lowered to permit rolling the wheels to the journal lathes.

To keep operations in proper sequence it was necessary to fit the mounting press with a new yoke designed to permit journals to pass through the machine. A quick-acting assembly truck carries the assembled wheels through the machine and releases them for the short run to the escalator. To eliminate the necessity of taking misfit wheels back to the demounting press machine, a yoke was designed to hang above the mounting press. This yoke can be lowered and the wheel pressed off.

The escalator used for raising the wheels from the shop floor to the outgoing track is operated by two chains and standard sprockets at the top and bottom of the escalator. Two arms, designed as integral parts of the chains, engage the axle and pull the wheels to the top of the escalator. As the arms lower over the top sprocket and the wheels are released to roll down the outgoing track to the yard, another pair of arms are raised at the bottom of the escalator to engage the next pair of wheels. As the wheels roll up the escalator, counterbalanced arms are pressed down and when the wheels have passed they automatically raise to prevent wheels from coming back down the escalator in the event the chains break. The escalator, controlled by push buttons located near the press, is driven by a $7\frac{1}{2}$ -hp. motor.



Pennsylvania car dismantling yard at Conway, Pa.



Separating yokes and couplers by a mechanical shear



Removing tail liners from coupler yokes



Reconditioning coupler yokes

Reclaiming Car Parts on the Pennsylvania

The Pennsylvania is now engaged in a freight car retirement program which is believed to be the largest project of its kind attempted at one time. The program includes about 32,000 box, hopper and gondola cars, equal to about 13 per cent of the freight-car equipment owned by the road, and, at its peak, was carried out at the rate of approximately 90 cars a day—22 at Terre Haute, Ind., 20 at Harrisburg, Pa., and 50 a day at the company's scrap and reclamation plant at Conway, Pa., near Pittsburgh.

Under the retirement plan, all cars subject to retirement are inspected when taken out of service for repairs, and if found unfit for repair are moved to the proper dismantling point where they are reduced to scrap by company forces working three shifts. About half the work is assigned to Conway because it is close to one of the largest freight classification yards of the railroad and has unusually extensive facilities for all stages of the work, including the reconditioning of materials suited for further use.

This plant is the largest railway scrap handling point in the country and employs about 450 men for all purposes. It occupies 90 acres of land, measures a half-mile in length from end to end of crane runway and has three gantry cranes as well as several locomotive cranes. The forward end of the truck yard, including about 1,000 ft. of land under the crane, is being used for all car dismantling, with the exception of the truck dismantling which is performed at the opposite end of the truck yard.

Condemned cars are brought to Conway in solid trains of 100 cars and are switched into the yard early each morning in 50-car lots, containing 20 box, 10 gondola and 20 all-steel hopper cars. The box cars and gondolas are placed on two parallel tracks within the craneway where the bodies can be removed by a gantry crane. One of these tracks is the outbound track for the scrap yard and the other is a stub-end track. The steel cars are placed partly on this stub-end track and partly on an adjacent spur where they are handled by locomotive crane.

During 1935, Pennsylvania forces repaired and otherwise reclaimed at Conway for further use 385,332 items of freight-car material, 6,744 tons of freight-car material being removed from scrap and shipped to the other points on the railroad for reclamation. The extent of



Ingenious fulcrum and air cylinder arrangement for closing coupler jaws

the repair work performed at this plant is shown in further detail in the table.

Items of Freight Car Material Repaired and Reclaimed at Conway, Year 1935

Coupler bodies	39,843
Coupler knuckles	40,948
Coupler knuckles and pins	38,245
Coupler knuckles, locks and lifts	32,464
Coupler yokes	29,620
Follower blocks	3,600
Striking plates	1,058
Carrier irons	2,501
Brake beams	48,692
Brake levers	3,784
Brake levers and spreaders	8,430
Brake hangers	18,386
Journal boxes	4,600
Journal bearings	22,800
Journal box lids	31,861
Journal box wedges	21,805
Hand brake wheels	2,117
Friction draft gears	807
Friction draft gear wedges	12,346
Truck center pins	12,475
Truck center plates	4,048
Truck bolsters pressed steel	863
Truck bolsters cast steel	2,299
Truck column castings	2,200
Bolts, square head cut off and rethreaded, tons	379
Nuts, all kinds, retapped, tons	82

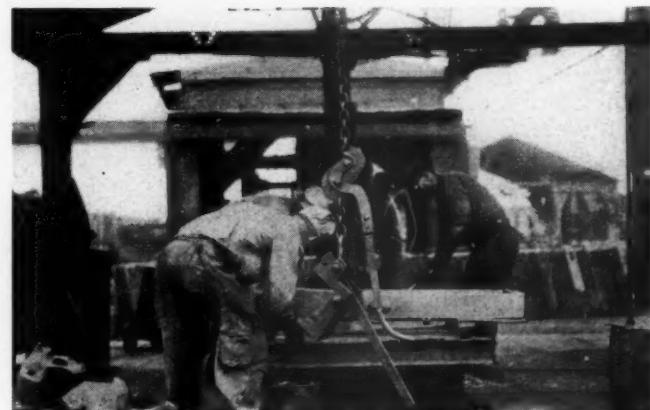
170 Couplers a Day

The plant is unusually well-equipped and organized to recondition couplers and brake beams. As the couplers with yokes are removed from condemned cars or separated from other materials in the scrap yard, they are brought to the reclamation yard by a gantry crane. The knuckles are detached and the couplers are then placed, four at one time, on a steel slide built about 3 ft. above the ground, where two men, one on each side, feed them under a press which separates the yoke from the coupler shank by a shearing action. This operation is performed at the rate of about 170 couplers a day. From this press the coupler slides down a chute to the ground on one side while the yoke is moved in the opposite direction to a second press where a third man shears off the tail liner. The yoke then moves on a gravity conveyor to the ground and the good yokes are passed through a furnace, then placed, while red hot, in a press which reshapes the yoke, shortens the lugs and automatically discharges finished yokes at the rate of about 25 an hour.

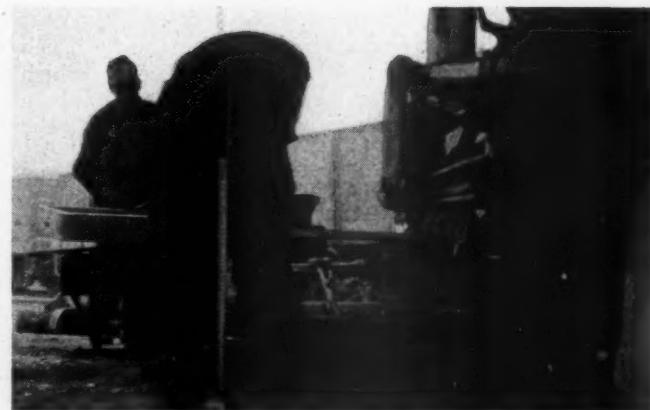
Meanwhile, the couplers are placed on an oil fire which holds four couplers and the heads brought to a red heat. They are then brought to their original contour by attaching the couplers, one at a time, to a fulcrum with a knuckle pin so that the shank is tilted upward. An air piston then forces the shank downward and thus squeezes the jaw into position. This operation is performed at the rate of about 150 couplers in eight hours. The couplers are then placed end to end on a conveyor



Press for straightening coupler shanks



Assembling couplers and yokes



Hydraulic press for rivets, couplers and yokes



Air cylinder device for feeding couplers through the annealing furnace



A belt conveyor carries brake beams into the shop



Worn heads and fulcrums slide down a chute to an open pit outside

equipped with an air piston, the pressure from which pushes one coupler into the annealing furnace at one end and a thoroughly annealed coupler out of the furnace at the other end. As the red-hot coupler emerges from the furnace, it slides under an air press and the shank is straightened. The coupler is then ready for re-assembling. One man fits the yoke to the coupler and rivets the tail liner, using a bull riveter. The assembly is then placed under a rivet press, a ratchet jack applied between the end of the yoke and the coupler to assure a tight fit, and rivets inserted and pressed home. Couplers are assembled in this manner at the rate of about 170 per day.

In a separate shop, all brake beams from dismantled cars or other stations in the scrap yard are inspected and reconditioned at the rate of 320 beams a day. The beams are fed into the plant on a conveyor which was improvised from old rail, 12-in. belting and pulleys, and they are completely dismantled at the rate of 40 an hour by two men using hand-controlled compressed-air motors which are installed at each end of the dismantling bench at the end of the conveyor. All heads and fulcrums which are worn or broken beyond repair are dropped into a chute which discharges them into an open pit outside the shop from which they can be loaded into cars by a magnet. All good heads are moved to the assembly table, while others are built up to proper contour by electric welding. All nuts are taken directly to the threaders in the shop where the good nuts are re-threaded and the scrap discarded. The rods are reconditioned by recutting the threads, and all channels are straightened cold on a press. The beams are assembled with the aid of mechanical nutters and are tested in a machine made of



The brake-beam testing station and equipment

improvised air presses. They are then stored adjacent to the shop ready for loading into cars by a gantry crane. The brake-beam crew consists of 10 men.

Conway is also equipped for rebuilding bolsters on a large scale. This operation is organized on a progressive plan under which the bolsters are moved from station to station at the rate of 35 bolsters a day, using a crew of eight men. The scrap bolsters are placed on skids made of old rail and all scrap material removed by torch. They are then passed into a completely enclosed welding shop where the bolsters are partially rebuilt and reinforced. Following this, the bolsters move out of the welding shop and the reconditioning is completed by two men.

While neither the wheel-mounting nor the truck-building operations are integral parts of the scrap and reclamation plant, being supervised by a separate organization, the truck-building operation is a noteworthy addition to the work which owes its location to the car-dismantling and car-material-reclaiming operation. The work is performed on 600 ft. of track supported 18 in. above the ground to facilitate the work. At two points rigid gallows of steel have been erected, each of which supports two side-swinging jib cranes and an overhead girder, which serve both as a trolley and a support for 4½-ton chain blocks. Mounted wheels are placed on this track by a locomotive crane and the wheels are then rolled under the gallows where new side frames are applied and the trucks assembled, using new brake beams, hangers, wearing plates, shoe keys, coppers and springs, and some reclaimed material. The present force comprises nine men who completely assemble 34 trucks a day by this method, although with the present equipment it is possible to assemble 80 trucks a day.



Reconditioning truck bolsters after welding



Station where trucks can be assembled at a rate of 80 a day

Surface Rolling Strengthens Press-Fitted Axle Assemblies

In a paper presented before the annual meeting of the American Society for Metals at Cleveland, Ohio, October 19 to 23, T. V. Buckwalter, vice-president, and Dr. O. J. Horger, research engineer of the Timken Roller Bearing Company, summarized a series of recent investigations made by the company, which indicated that:

1. A press-fit member reduces the fatigue-strength of an axle to less than half the strength of a similar axle not having a press-fitted member.

2. Surface-rolling the axle at the press-fitted section practically restores the full strength of the axle, making it possible to utilize in press-fitted assemblies practically the same strength as is available in plain axles which do not have press-fitted members.

In testing a 2-in. axle, made of S. A. E. 1045 steel, normalized and drawn, the fatigue strength of the axle in a press-fitted assembly was increased from 14,000 to 33,000 lb. per sq. in. by surface-rolling with a roll pressure of 2,400 lb. In the case of a 2.75 per cent nickel steel axle, quenched and tempered, the fatigue strength was increased from 17,000 to 38,000 lb. per sq. in. by surface-rolling the axle with a roll pressure of 400 lb.

To determine the effect of surface rolling in large axles and to secure further data relating to forging and heat-treating practice as well as on other problems associated with large sections, the Timken Roller Bearing Company is building a fatigue-testing machine capable of testing axles up to 13½ in. in diameter.

Questions and Answers On the AB Brake

Branch-Pipe Tee

96—Q.—How is this fitting used? A.—To connect the branch pipe to the brake pipe.

97—Q.—What is its purpose? A.—To prevent excessive moisture in the brake pipe from passing into the branch pipe and from passing from that pipe to the AB valve.

98—Q.—How is this accomplished? A.—The interior is such that the passage leading to the branch pipe comes out of the top, with the result that moisture and heavy particles of dirt pass on through the brake pipe.

99—Q.—How is this device connected? A.—By means of re-inforced flanged unions, and is bolted to the car underframing by means of a lug cast on the body.

Pressure-Retaining Valve

100—Q.—What type retaining valve is used with the AB equipment? A.—The standard for freight equipment cars, a three-position 10-20 lb. duplex spring type, having a nominal blow-down value of 50 sec. in the 10-lb. position and 90 sec. in this 20-lb. position.

101—Q.—To what is this valve connected? A.—To the AB valve exhaust connection in the bracket portion.

102—Q.—Name the operating parts. A.—Cock key and two valves and springs.

103—Q.—How many outlets does the cock key have? A.—Three. One to the atmosphere through the pipe tap "EXHAUST," one to the low-pressure side of the retaining valve proper, and another to the high-pressure side.

104—Q.—What is the position of cock key handle

when connection is made to the pipe tap "EXHAUST"?

A.—Down, in a vertical position.

105—Q.—What connection is made in this position? A.—The AB exhaust is open through the retaining-valve pipe, thence through the cock key and retaining-valve "EXHAUST" connection to the atmosphere.

106—Q.—What is the position of the handle to retain 10 lb. in the brake cylinder? A.—Up. In a horizontal position.

107—Q.—What connection is then made? A.—The AB exhaust is open through the cock key to the passage under one of the valves, and when sufficient pressure is obtained to overcome the 10-lb. spring, the valve unseats and the air passes through the vent port to the atmosphere.

108—Q.—What is the position of handle for high pressure? A.—Intermediate position, marked "HP."

109—Q.—What connection is then made? A.—The AB exhaust is open through the cock key to the passage under one of the valves which becomes unseated when the pressure exceeds 10 lb., the load value of the valve spring. The air above this valve passes through a choke to the under side of another valve which is also held seated by a 10-lb. spring. Therefore, air at 10-lb. pressure is added to the spring force of the first valve, making a total force of 20 lb. acting on this valve to keep it seated. The first valve, therefore, closes with less than 20-lb. cylinder pressure, thereby retaining this pressure. Air which passes both valves flows to the atmosphere through the choked vent port in the long valve cap.

110—Q.—What chokes are incorporated in the retaining valve? A.—Two. One in the passage between the two valves and the other in the vent port.

111—Q.—What advantageous feature is incorporated with the valves? A.—The valves and springs are permanently enclosed in the cap nuts.

112—Q.—What is the benefit of this arrangement? A.—It prevents a possibility of spring distortion and assures permanent closing values.

Operation of the Equipment

113—Q.—Name the various positions of the AB valve. A.—Full release and charging. Retarded recharge. Preliminary quick-service (consisting practically of three steps). Service (which consists of two steps). Service lap. Emergency, first, second and third stages. Release after emergency. Accelerated emergency release.

114—Q.—What ports are open in full release and charging positions? A.—Brake pipe to auxiliary reservoir via both feed grooves in service piston bushing. Brake pipe to accelerated-release valve chamber. Brake pipe to quick-action chamber via charging choke. Brake pipe to vent valve chamber. Brake pipe to by-pass checks. Auxiliary reservoir to emergency reservoir via service slide valve chamber through a restricted port in the service slide valve at the left end of the graduating valve. Auxiliary reservoir to release insuring valve. Auxiliary reservoir to auxiliary reservoir check in the duplex release valve. Emergency reservoir to chambers over spill-over checks and strut diaphragm. Emergency reservoir to its check in the duplex release valve. Quick action chamber to accelerated release piston chamber. Brake cylinder to atmosphere via retaining valve.

115—Q.—What ports open in retarded recharge position? A.—The same as in full release, with the exception that flow of air from brake pipe to auxiliary reservoir is restricted to one feed groove.

116—Q.—What ports open in preliminary quick service position? A.—Brake pipe to atmosphere via service graduating valve and slide valve, quick service volume

and preliminary quick service choke plug. Brake pipe to by-pass checks, to vent valve chamber, and to accelerated release check valve chamber. Auxiliary reservoir to release insuring valve and to the auxiliary reservoir check in the duplex release valve. Quick action chamber to atmosphere and to accelerated release piston chamber. Emergency reservoir to spill-over checks and strut diaphragm and to its check in the duplex release valve. Brake cylinder to atmosphere via retaining valve.

117.—*Q.—What ports open in service position?* A.—In the first step or stage of service which constitutes a quick service application, the following ports are open: Brake pipe to brake cylinder via back-flow and limiting valve checks and inshot valve. Brake pipe to vent valve chamber and to accelerated-release check valve chamber. Auxiliary reservoir to brake cylinder via service slide valve and inshot valve. Auxiliary reservoir to release insuring valve and to the auxiliary reservoir check in the duplex release valve. Quick action chamber to atmosphere and to accelerated-release piston chamber. Emergency reservoir to spill-over checks and strut diaphragm, and to the emergency reservoir check in the duplex release valve. Inshot piston volume to the chamber back of the inshot piston.

have been incorporated to provide such important advantages as greater rigidity, higher speeds, longer life of screws and nuts, and better accessibility for inspection and maintenance.

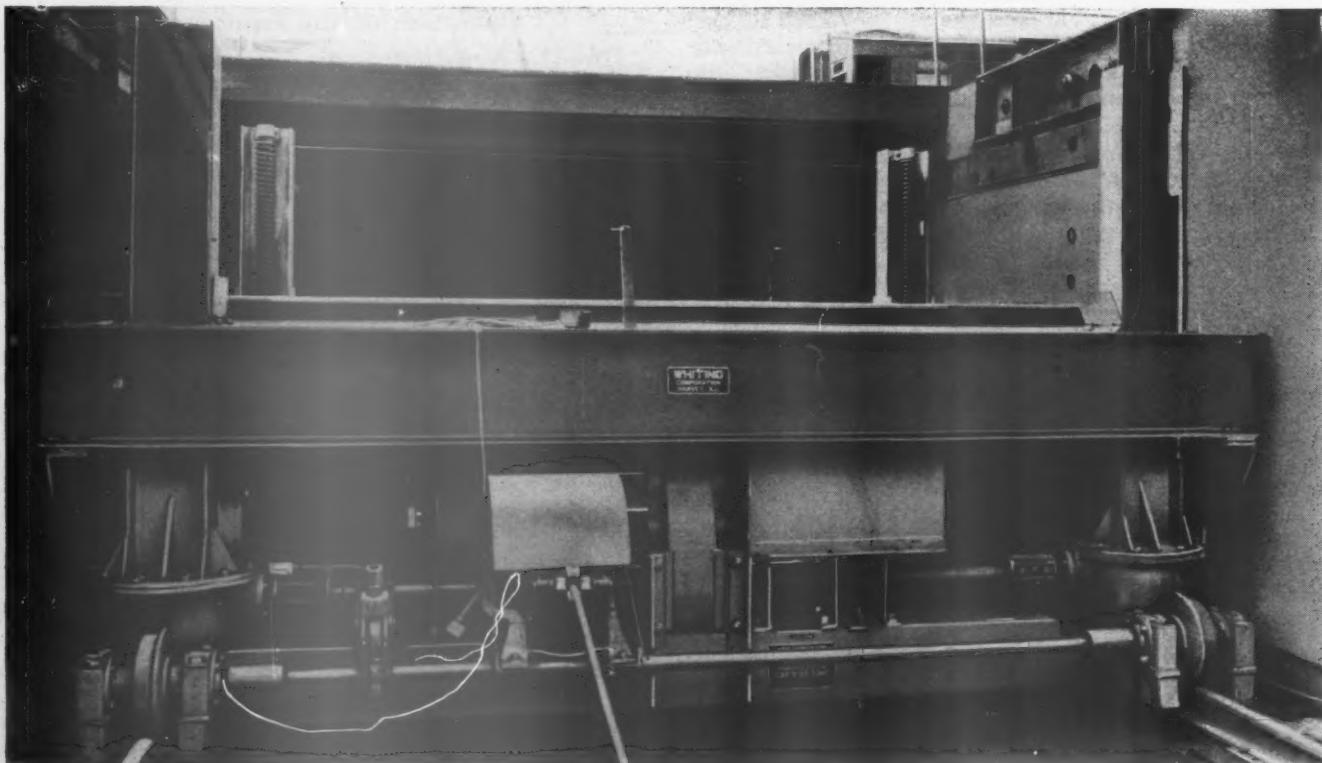
Instead of having a heavy superstructure raised and lowered through worm gearing, the Model-B drop table is equipped with bevel gears mounted on the truck. The table top is supported by two cross, or lifting, beams resting on bronze nuts, as in the case of beams used on Whiting locomotive hoists. The lifting beams are raised and lowered by rotating the screws. The provision of a heavy vertical H-beam around each screw supports and braces the screw at the upper end. This gives greater rigidity and, in conjunction with the use of larger diameter screws and nuts, reduces screw and nut wear and assures longer life for these parts. The screws are made of high-carbon steel with buttress threads of liberal size for the rated loads.

The use of bevel gears in place of worm gears permits higher hoisting speeds and with single-speed motors it is now possible to obtain hoisting speeds as high as 4 ft. per min. A herringbone-gear speed reducer, mounted on the truck in an accessible position, is provided to transmit power from the motor to the bevel gears which operate the screws. The motor and solenoid brakes are likewise mounted on the truck. The table top is of simplified construction, using a heavy single H-beam for the main support of each table top rail. Effective locking bars are provided for locking the top in position at ground level. The table is designed to accommodate either plain or compound tops.

Each of the four truck wheels is mounted between two roller bearings, pressure-lubricated and of ample size for the rated load. The table is easily racked to side position by a hand ratchet device. A motor-operated racking device is furnished, if desired, at extra cost. All of the operating machinery is mounted on the truck at a sufficient height from the pit floor to eliminate any water hazard and to make it readily accessible for inspection and maintenance.

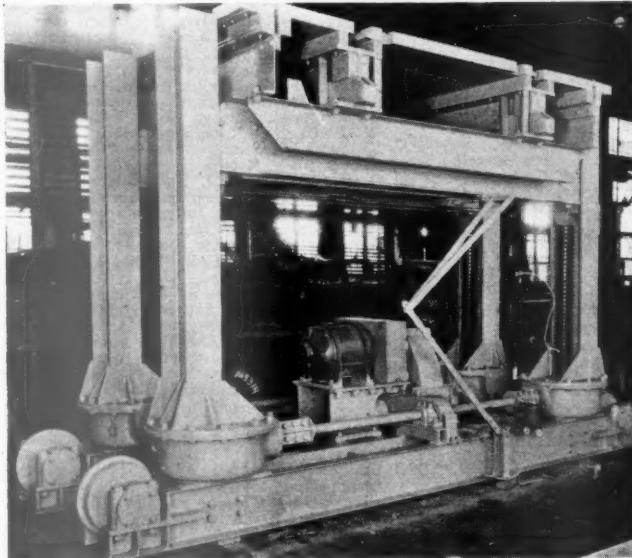
Drop Pit Table Of Improved Design

The Whiting Corporation, Harvey, Ill., has developed and is now introducing a new Model-B drop pit table which incorporates a number of changes over earlier designs, brought about largely by increased demands made upon such equipment since the introduction of streamline trains in railway service. The drop table incorporates the screw principle which has been the basic element in all Whiting locomotive and car jack equipment for the past 25 years, but improvements in detail design



Whiting 60-ton capacity Model-B drop-pit table with all-steel table top 18 ft. 6 in long by 13 ft. wide used to drop wheels and trucks of streamline trains

A new design of compound table top has been developed for use with either standard or Model-B Whiting drop pit tables. As shown in one of the illustrations, a small top is provided within the large one, each having its own set of locking bars and so arranged that a complete lead truck, trailer, tender or passenger-car truck can be dropped on the large and small top operating as one unit; or a single pair of wheels can be



Model B 65-ton drop table for narrow pit, with drive mechanism mounted on truck within the structure—Racked through gear-head motor and equipped with spring wind-up reel—Table-top distance across the pit, 6 ft.

dropped on the small or inner top, with the large top locked in normal position at ground level. The compound top can also be used to handle single or multiple pairs of driving wheels.

The new Whiting compound drop-table top consists of a large rectangular frame with the side girders, spanning the pit, made exceptionally heavy as they must support the weight of the locomotive resting on the top. These two heavy girders are equipped with four locking bars that engage pockets in the side walls of the pit. This

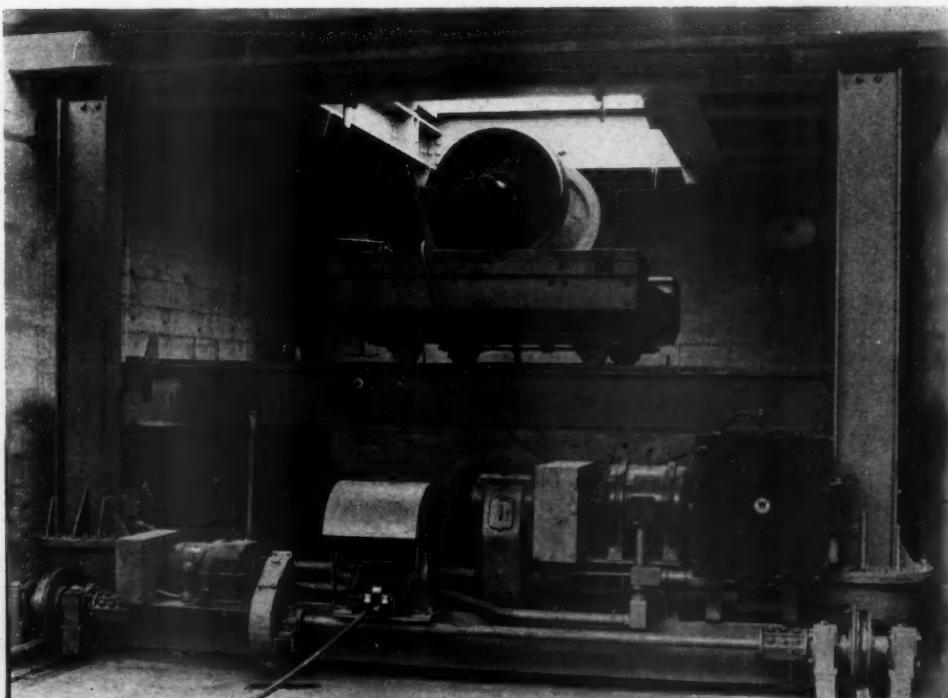
rectangular frame has other steel cross members riveted to it to provide a well at its center into which the small table top fits. End and center cross members are connected by additional members on the upper surface of which are rails on which the equipment, whether individual car, locomotive or streamline train, can run over the large top.

The small table top consists of a steel rectangular frame with cross girders within, on the upper surfaces of which are rails coinciding with the rails of the large top for running locomotives across. The small top is also equipped with locking bars. The small table top on its under surface has four retractable wheels 6 in. in diameter that can contact with railed beams on the drop table superstructure.

When the large and small table tops are to be operated as one unit, the retractable wheels of the small top are swung into "clear." As the machine's superstructure rises, it finally contacts the large and small top simultaneously and can raise the complete assembly a short distance for release of the locking bars, or a total distance of 6 in. for doing necessary work. Later, if necessary, both tops (as one) may be lowered under load any distance that may be required by the nature of the work.

If both tops are locked in place—the large to the side walls of the pit—the small to the large top—and it is desired to drop the small top only, the retractable wheels of the small top are swung down to operative position. As the drop table's superstructure is elevated, its railed beams contact these four 6-in. wheels of the small top when still 6 in. away from the large top. It is therefore possible to raise the small top either 6 in. above the large top for certain work, or a shorter distance for release of the small-top locking bars from the large top. After this is done, the small top with its load may lower through the large top, with movement continued until clearance is obtained. After racking sidewise, the small top is raised level with the releasing track and is rolled with its load to the side wall of the pit by means of its four wheels and railed superstructure. After reaching the side wall, its locking bars engage special wall pockets to anchor the table top and keep it from tilting while the load is being rolled off.

Model B 60-ton drop-pit table with compound top—Large top locked at ground level and small top lowering a single pair of wheels



Among the Clubs and Associations

NEW ENGLAND RAILROAD CLUB.—Hot Boxes will be the subject discussed by C. B. Smith, engineer of Tests, Boston & Maine, before the meeting to be held at 6:30 p.m., December 8, at the Hotel Touraine, Boston, Mass.

CAR FOREMEN'S ASSOCIATION OF CHICAGO.—C. J. Hayes, supervisor of A. A. R. Billing, New York Central, will discuss the Handling of Car Repair Bills at the meeting to be held at the LaSalle Hotel, Chicago, on December 14 at 8 p.m.

MECHANICAL DIVISION, A. A. R.—The general committee of the Mechanical Division, A.A.R., and the general committee of the Purchases and Stores Division, at a meeting in New York on Thursday, decided to hold their annual convention in Atlantic City, N. J., next June. The Railway Supply Manufacturers Association will co-operate by having an exhibit. It is seven years since a joint convention and exhibit of this sort has been held.

DIRECTORY

The following list gives names of secretaries, dates of next regular meetings, and places of meetings of mechanical associations and railroad clubs:

AIR-BRAKE ASSOCIATION.—T. L. Burton, care of Westinghouse Air Brake Company, 3400 Empire State Building, New York.

ALLIED RAILWAY SUPPLY ASSOCIATION.—F. W. Venton, Crane Company, Chicago.

AMERICAN RAILWAY TOOL FOREMEN'S ASSOCIATION.—G. G. Macina, 11402 Calumet avenue, Chicago.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—C. E. Davies, 29 West Thirty-ninth street, New York.

RAILROAD DIVISION.—Marion B. Richardson, 192 East Cedar street, Livingston, N. J.

MACHINE SHOP PRACTICE DIVISION.—G. F. Nordenholz, 330 West Forty-second street, New York.

MATERIALS HANDLING DIVISION.—F. J. Shepard, Jr., Lewis-Shepard Co., Watertown Station, Boston, Mass.

OIL AND GAS POWER DIVISION.—M. J. Reed, 2 West Forty-fifth street, New York.

FUELS DIVISION.—W. G. Christy, Department of Health Regulation, Court House, Jersey City, N. J.

ASSOCIATION OF AMERICAN RAILROADS.—J. M. Symes, vice-president operations and maintenance department, Transportation Building, Washington, D. C.

DIVISION I.—OPERATING.—SAFETY SECTION.—J. C. Caviston, 30 Vesey street, New York.

DIVISION V.—MECHANICAL.—V. R. Hawthorne, 59 East Van Buren street, Chicago.

COMMITTEE ON RESEARCH.—E. B. Hall, chairman, care of Chicago & North Western, Chicago.

DIVISION VI.—PURCHASES AND STORES.—W. J. Farrell, 30 Vesey street, New York.

DIVISION VIII.—MOTOR TRANSPORT.—CAR SERVICE DIVISION.—C. A. Buch, Transportation Building, Washington, D. C.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS.—Jos. A. Andreucetti, C. & N. W., 1519 Daily News Building, 400 West Madison street, Chicago, Ill.

CANADIAN RAILWAY CLUB.—C. R. Crook, 2271 Wilson avenue, Montreal, Que. Regular meetings, second Monday of each month, except in June, July and August, at Windsor Hotel, Montreal, Que.

CAR DEPARTMENT OFFICERS' ASSOCIATION.—A. S. Sternberg, master car builder, Belt Railway of Chicago, 7926 South Morgan street, Chicago.

CAR FOREMEN'S ASSOCIATION OF CHICAGO.—G. K. Oliver, 2514 West Fifty-fifth street, Chicago. Regular meetings, second Monday in each month, except June, July and August, La Salle Hotel, Chicago.

CAR FOREMEN'S ASSOCIATION OF OMAHA, COUNCIL BLUFFS AND SOUTH OMAHA INTERCHANGE.—H. E. Moran, Chicago Great Western, Council Bluffs, Ia. Regular meetings, second Thursday of each month at 1:15 p. m.

CENTRAL RAILWAY CLUB OF BUFFALO.—Mrs. M. D. Reed, Room 1817, Hotel Statler, Buffalo, N. Y. Regular meetings, second Thursday each month, except June, July and August, at Hotel Statler, Buffalo.

EASTERN CAR FOREMEN'S ASSOCIATION.—E. L. Brown, care of the Baltimore & Ohio, St. George, Staten Island, N. Y. Regular meetings, fourth Friday of each month, except June, July, August and September.

INDIANAPOLIS CAR INSPECTION ASSOCIATION.—R. A. Singleton, 822 Big Four Building, Indianapolis, Ind. Regular meetings, first Monday of each month, except July, August and September, at Hotel Severin, Indianapolis, at 7 p. m.

INTERNATIONAL RAILWAY FUEL ASSOCIATION.—See Railway Fuel and Traveling Engineers' Association.

INTERNATIONAL RAILWAY GENERAL FOREMEN'S ASSOCIATION.—William Hall, 1061 West Washburn street, Winona, Minn.

INTERNATIONAL RAILWAY MASTER BLACKSMITHS' ASSOCIATION.—W. J. Mayer, Michigan Central, 2347 Clark avenue, Detroit, Mich.

MASTER BOILER MAKERS' ASSOCIATION.—A. F. Stiglmeier, secretary, 29 Parkwood street, Albany, N. Y. Annual meeting, September 16 and 17, Hotel Sherman, Chicago.

NEW ENGLAND RAILROAD CLUB.—W. E. Cade, Jr., 683 Atlantic avenue, Boston, Mass. Regular meetings, second Tuesday in each month, except June, July, August and September, at Hotel Touraine, Boston.

NEW YORK RAILROAD CLUB.—D. W. Pye, Room 527, 30 Church street, New York. Meetings, third Friday in each month, except June, July, August and September, at 29 West Thirty-ninth street, New York.

NORTHWEST CAR MEN'S ASSOCIATION.—E. N. Myers, chief interchange inspector, Minnesota Transfer Railway, St. Paul, Minn. Meetings, first Monday each month, except June, July and August, at Midway Club rooms, University and Prior avenue, St. Paul.

PACIFIC RAILWAY CLUB.—William S. Wollner, P. O. Box 3275, San Francisco, Cal. Regular meetings, second Thursday of each month in San Francisco and Oakland, Cal., alternately—June in Los Angeles and October in Sacramento.

RAILWAY CLUB OF GREENVILLE.—J. Howard Waite, 43 Chambers avenue, Greenville, Pa. Regular meetings, third Thursday in month, except June, July and August.

RAILWAY CLUB OF PITTSBURGH.—J. D. Conway, 1941 Oliver Building, Pittsburgh, Pa. Regular meetings, fourth Thursday in month, except June, July and August, Fort Pitt Hotel, Pittsburgh, Pa.

RAILWAY FIRE PROTECTION ASSOCIATION.—R. R. Hackett, Baltimore & Ohio, Baltimore, Md.

RAILWAY FUEL AND TRAVELING ENGINEERS' ASSOCIATION.—T. Duff Smith, 1660 Old Colony building, Chicago.

RAILWAY SUPPLY MANUFACTURERS' ASSOCIATION.—J. D. Conway, 1941 Oliver Building, Pittsburgh, Pa. Meets with Mechanical Division and Purchases and Stores Division, Association of American Railroads.

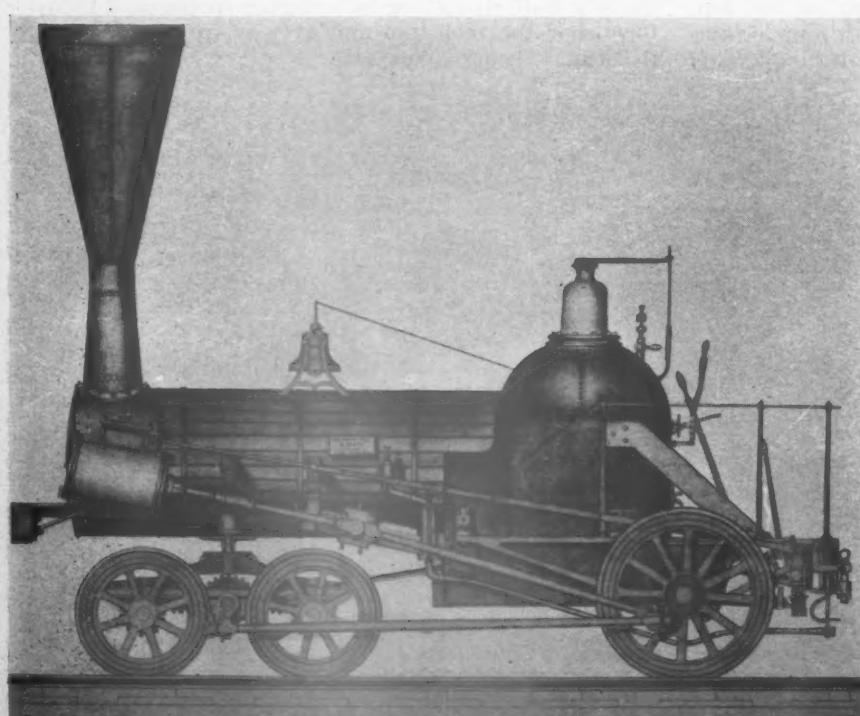
SOUTHERN AND SOUTHWESTERN RAILWAY CLUB.—A. T. Miller, P. O. Box 1205, Atlanta, Ga. Regular meetings, third Thursday in January, March, May, July and September. Annual meeting, third Thursday in November, Ansley Hotel, Atlanta, Ga.

TORONTO RAILWAY CLUB.—R. H. Burgess, Box 8, Terminal A, Toronto, Ont. Meetings, fourth Monday of each month, except June, July and August, at Royal York Hotel, Toronto, Ont.

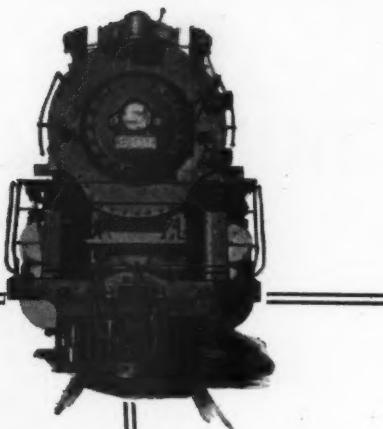
TRAVELING ENGINEERS' ASSOCIATION.—See Railway Fuel and Traveling Engineers' Association.

WESTERN RAILWAY CLUB.—C. L. Emerson, executive secretary, 822 Straus Building, Chicago. Regular meetings, third Monday in each month, except June, July, August and September.

(Turn to next left-hand page)



A locomotive of the decade, 1830-40



Locomotive Designs are CHANGING

Locomotives recently purchased and those being considered today provide higher horsepower capacity and higher speeds in line with present day operating conditions. » » » Lima's engineers will gladly consult with you and recommend designs that provide this higher capacity to meet modern requirements.



LIMA LOCOMOTIVE WORKS

LIMA
LOCOMOTIVE WORKS
INCORPORATED

INCORPORATED, LIMA, OHIO



Globe photo

Through the cab window of a British locomotive

NEWS

Air-Conditioning Programs

THE Union Pacific will spend a total of \$500,000 in modernizing and air-conditioning 40 passenger cars in its Omaha shops.

The Nashville, Chattanooga & St. Louis will spend \$123,377 on an air-conditioning program, to be carried out this fall and the early part of next year. With the completion of this program, all cars used in main line service will be air-conditioned.

The Louisville & Nashville has authorized an appropriation of \$800,000 to cover its air-conditioning program of passenger cars for next year. This includes the equipping of 80 all-steel coaches and three dining cars. This work will be carried out in the railroad's South Louisville, Ky., shops as soon as possible in order to have the equipment in service early next Spring. These cars, together with the 39 coaches and 13 diners, air-conditioned by the road and the Pullman cars thus equipped, will provide completely air-conditioned service on practically every Louisville & Nashville main line train, except some locals. It does not include local or suburban service.

R. B. A. Annual Meeting

At its annual meeting in New York on November 5, the Railway Business Association re-elected its officers and executive committee, and appointive officers were re-appointed. Three new members were added to the governing board as follows: Carl C. Gibbs, president, National Malleable & Steel Castings Co.; N. J. Clarke,

president, Republic Steel Corporation; J. H. Rodger, Oxfeld Railroad Service Company.

At the annual dinner, preceding the address of Dr. H. G. Moulton, President Harry A. Wheeler reviewed briefly the success of the program of the association in promoting the study of the probable effects of government ownership on the railroad industry—and the great volume of public sentiment against such an eventuality which has thereby been developed.

Research and Unification Progressed During 1936

RAILROAD research activities "reached a new high level in 1936" and rapid progress is being made on studies of projects involving proposed co-ordination of facilities and services, according to reports made at the regular fall meeting of the Association of American Railroads, held in the Hotel Biltmore, New York, on November 6.

The review of railroad research in 1936 showed that such activities during the current year have been concerned with virtually every phase of railroad operation. Listed as "outstanding" were studies of the A.A.R. Division of Equipment Research with respect to air conditioning. The object of these studies, on which a report will soon be ready, has been to ascertain what improvements can be made in the present air-conditioning systems and what can be done toward standardizing that equipment.

Other current research activities include

motive power efficiency studies of railroads and locomotive builders; experiments of individual roads, the A.A.R. and car builders to determine the extent to which steel alloys are practical for passenger and freight cars; experiments of manufacturers in connection with fusion welding of tank cars; studies designed to improve brake shoes, and the draft gear tests at Purdue University.

In connection with the co-ordination studies it was pointed out that 48 have been completed, 10 of which are now being put into effect. In addition, 673 projects are being re-examined in the light of changed labor and traffic conditions.

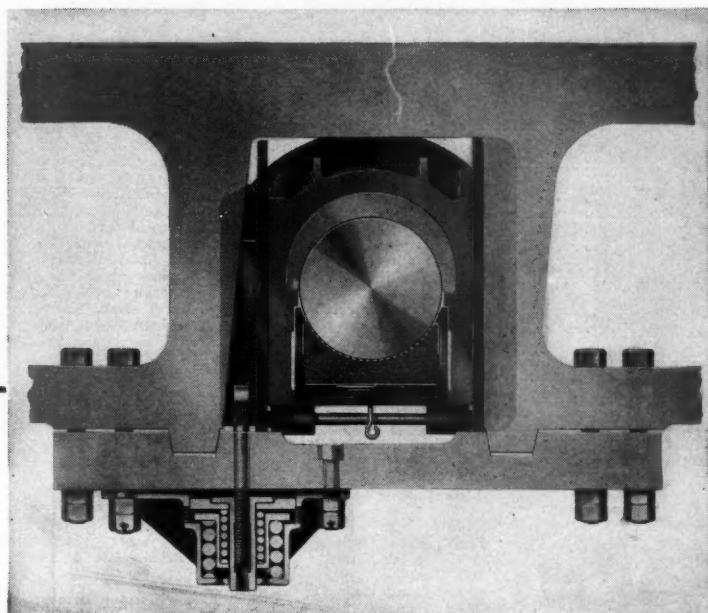
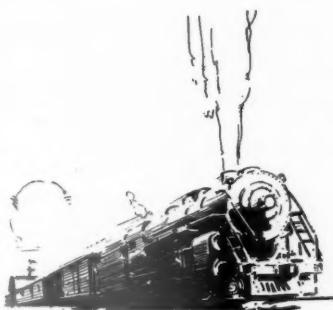
Western Pacific 1937 Improvement Program

THE Western Pacific, following approval by the federal district court on October 28, will spend \$7,000,000 for improvements to road and equipment and for the purchase of new locomotives and freight cars in 1937. Of the total \$4,465,955 is for improvements to road and equipment and \$2,605,000 is for the purchase of new locomotives and freight cars. These expenditures authorized by the court represent the second phase of a three-year program of improvements which was initiated shortly after the beginning of this year and which will involve an ultimate aggregate outlay of more than \$14,000,000 for improvements and new equipment. It is expected that this improvement

(Turn to next left-hand page)

MAINTAINING DRIVING BOX ADJUSTMENT

. . . is a complicated problem



Holding driving boxes so they do not pound and do not stick, is impossible under the old methods.

Regardless of box expansion due to temperature change freedom of vertical movement must be maintained.

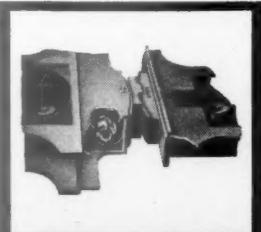
Ample cushioned resistance to horizontal movement between the pedestal jaws must be provided to hold the box against pounding yet shield and cushion unusual shocks that otherwise might overstress parts and cause failure.

The Franklin Automatic Compensator and Snubber holds the box in adjustment at all times, by compensating for expansion and providing a yielding cushioned resistance to excessive blows.

It reduces maintenance, protects the track structure and vastly improves the riding quality of the locomotive. To the locomotive it is what the shock absorber is to your automobile.

Its twin, the Type E-2 Radial Buffer, prevents all slack between engine and tender and dampens oscillation between these units which further improves the riding qualities of the locomotive.

Because material and tolerances are just right for the job, genuine Franklin repair parts give maximum service life.



Franklin Type E-2 Radial Buffer dampens oscillation between engine and tender and makes for easier riding.



FRANKLIN RAILWAY SUPPLY COMPANY, INC.

NEW YORK

CHICAGO

MONTREAL

ment program will be completed during 1938.

The 1937 improvement program in part is as follows:

Engine terminal improvements, installation of additional stalls with drop pits, and enlarged turntables at Oroville, Cal., Elko, Nev. and Wendover, Utah \$266,068

Heavy repairs and improvements to equipment include:

The substitution of steel sides and doors for wooden sides and doors on 100 box cars \$149,300
The installation of Evans loaders on 50 automobile cars \$49,500
Repairs to 500 box cars \$200,000

Conversion of 100 forty-foot box cars into single-deck stock cars \$36,000
Conversion of 100 thirty-six-foot single-deck stock cars into double-deck cars \$14,000
The substituting of cast steel side frames for arch bar trucks on 2,520 freight cars \$525,033
The modernizing of passenger cars and the installation of air-conditioning equipment \$39,817
The installation of modern economy and efficiency devices on locomotives \$25,000
Additional tools and appliances for the company's general shops at Sacramento, Cal., and for various enginehouses \$105,000
Expenditures for new motive power and new equipment include:
The purchase of seven 4-6-6-4 high-speed freight locomotives for service in Nevada and

Utah, and four 2-8-2 type locomotives for service in the Feather River Canyon, Cal. \$1,580,000

The purchase of two hundred 40-ft., 50-ton box cars; fifty 50-ft., 50-ton flat cars; 100 hopper cars and one 200-ton wrecking crane \$1,025,000

Letter Ballot Returns

THE recommendations of various committees reporting at the Mechanical Division meeting held at Chicago, June 25 and 26, were ordered submitted to a letter ballot, the results of which have just been made available. These recommendations comprised a total of 99 propositions, divided between the various committees as follows: Brakes and Brake Equipment, 5; Car Construction, 6; Couplers and Draft Gears, 6; Air Conditioning and Equipment Lighting, 1; Loading Rules, 55; Locomotive Construction, 4; Lubrication of Cars and Locomotives, 1; Specifications for Materials, 14; Tank Cars, 4; Wheels, 3. All of these propositions to amend the standard and recommended practice of the Mechanical Division have been approved effective March 1, 1937, with the exception of proposition No. 5 covering Specifications for Repairs to Freight Equipment Brake Beams, which is approved effective January 1, 1937, and proposition No. 10 covering Definition and Designating Letters, which is approved effective immediately. Also, the proposition to amend the Loading Rules of the Division are approved, effective January 1, 1937. Detailed information regarding this letter ballot is made available in the Mechanical Division's circular No. D. V.—885 just issued by Secretary V. R. Hawthorne.

New Equipment

LOCOMOTIVE ORDERS

Road	No. of locos.	Type of loco.	Builder
Aluminum Co. of America	1	600-hp. Diesel-elec.	American Loco. Co.
C. B. & Q.	10 ¹	Either frt. or pass. serv.	Company shops
C. M. St. P. & P.	1 ²	Streamline steam	Baldwin Loco. Works
C. R. I. & P.	30 ³	4-8-4	American Loco. Co.
New York Central	6 ⁴	Hiawatha	Electro-Motive Corp.
Norfolk & Western	50 ⁵	1,200-hp. Diesel-elec.	American Loco. Co.
Union Pacific	50 ⁶	Hudson	Lima Loco. Works
Utah Copper Co.	8	8-wheel switchers	Company shops
W. & L. E.	12	Freight	American Loco. Co.
	10 ⁷	4-8-4	General Elec. Co.
	10 ⁸	85-ton elec.	American Loco. Co.
	10 ⁹	2-8-4	American Loco. Co.

LOCOMOTIVE INQUIRIES

B. & L. E.	10	Texas, frt.
D. L. & W.	2	8-wheel switchers
Union R. R.	5	4-6-4 pass.
Western Maryland	4	10-wheel switchers
	10	2-6-6-4

FREIGHT CAR ORDERS

Road	No. of cars	Type of car	Builder
C. & E. I.	500 ⁷	50-ton box	Gen. Amer. Trans. Corp.
C. R. I. & P.	350 ⁸	50-ton auto.	American Car & Fdry. Co.
G. M. & N.	300	50-ton box	American Car & Fdry. Co.
Norfolk & Western	500	Gondolas	Company shops
Union Pacific	300	Hopper	Mt. Vernon Car Mfg. Co.
Western Maryland	500	Underframes ⁹	Bethlehem Steel Co.
	100	50-ton box	
		50-ton gondolas	

FREIGHT CAR INQUIRIES

B. & L. E.	1,000	90-ton hopper
	500	70-ton hopper
C. & O.	500	50-ton gondolas
	1,000	50-ton hopper
	500	50-ton box
D. M. & N.	500	50-ton gondolas
250, 500, or 1,000	70-ton ore	
C. & N. W.	50	75-ton hopper
E. J. & E.	750	70-ton hopper
	100	50-ton gondolas
Norfolk & Western	200	50-ton gondolas
Norfolk Southern	1,000	Hopper
Union R. R.	25	40-ton auto.
Virginian	900	70-ton gondola
Warrior River Ter. Co.	25	50-ton auto. box
Western Pacific	20	40-ton box
	200	50-ton box

PASSENGER CAR ORDERS

Road	No. of cars	Type of car	Builder
C. R. I. & P.	20 ¹⁰	Coaches	Edward G. Budd Mfg. Co.
Union Pacific	40 ¹¹	Diners	Pullman Std. Car Mfg. Co.
	5 ¹²	Kitchen-dormitory	

¹ These 11 locomotives cost more than \$1,000,000.

² Orders subject to approval of the Federal Court and the I. C. C.

³ These locomotives will be used to haul four three-car trains and two four-car trains, the twenty cars for which have been ordered from the Edward G. Budd Mfg. Co. The cars will be of conventional size and shape, except the last car of each train which will be of streamline design to provide a solarium observation lounge. Each train will be partly articulated, the three-car trains riding on five trucks and the four-car trains on six trucks. The trains will be air conditioned throughout, and will provide accommodations for 120 passengers in coach sections; 26 in observation lounge, and 16 in dinette, the four-car trains each having 60 additional seats in the extra coach.

⁴ These 100 locomotives which are for delivery early next year, will cost approximately \$8,600,000.

⁵ To cost approximately \$3,000,000.

⁶ To have 25-in. by 34-in. cylinders and a total weight in working order of 431,000 lb.

⁷ Authorized by federal district court at Chicago.

⁸ Subject to approval of the court.

⁹ For 300, 50-ft. automobile cars to be built in company shops. \$1,500,000 will be spent by the Union Pacific for car rehabilitation and construction in company shops.

¹⁰ The cost of the 40 coaches and 5 diners for use on the Challenger, is estimated at \$3,500,000. The diners are to be of the coffee-shop type.

P. W. A. Railroad Loans Net Profit to Government

PUBLIC Works Administration loans, \$200,529,000 to 32 railroads for rolling stock, motive power, modernization and improved plant, made possible work-producing construction and resulted in a profit of \$3,218,247 to the Public Works Administration from the sale of a portion of the bonds and securities accepted by it to cover the loans, according to a special report made by the Accounting Division to Administrator Harold L. Ickes.

PWA's loans enabled the 32 railroads to construct and purchase three high-speed streamlined trains, 195 locomotives, 303 passenger cars, 36 mail and express cars which went to make up a number of other well-known high-speed trains; and 24,170 freight cars. It also enabled the repair and reconditioning of 1,928 locomotives, 947 passenger cars, 40,877 freight cars, and the equipment of 300 freight cars with automatic loaders. Considerable reconstruction of roadbeds, bridges, culverts, and other structures also took place, including completion of the electrification of the Pennsylvania from New York to Washington.

The PWA Division of Transportation Loans, organized in the fall of 1933, has been abolished by PWA. The personnel has been transferred to RFC.

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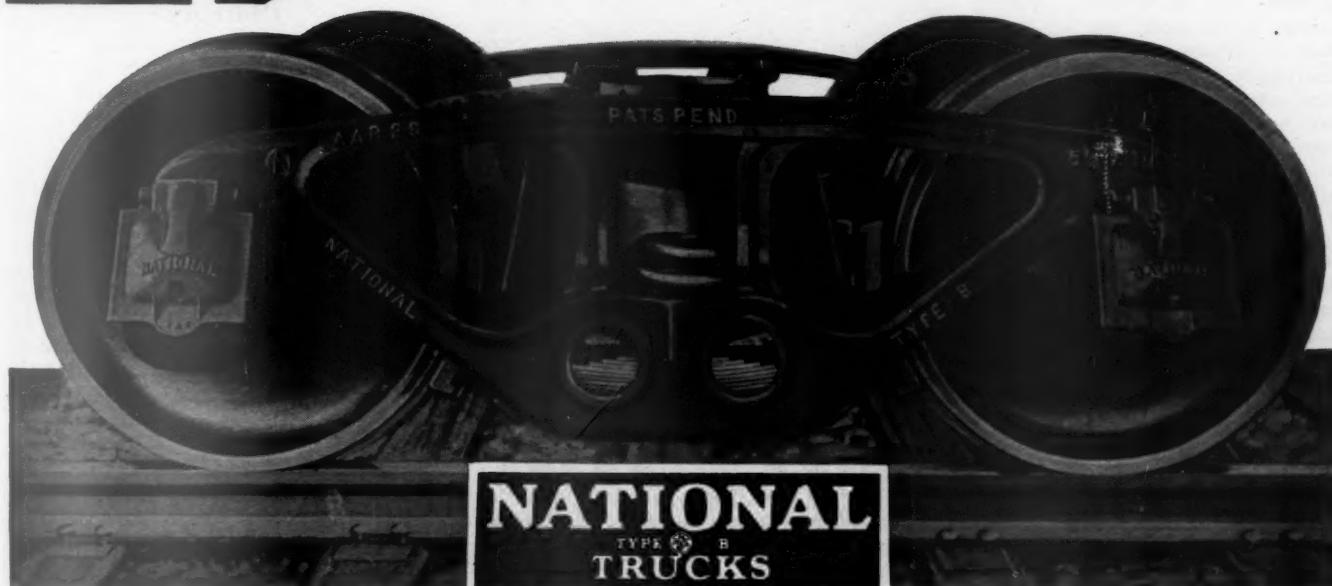
NATIONAL Type B Spring- Plankless Trucks

are provided with either coileaf or all-coil spring suspension. Their 11 outstanding points make them the most economical and safest truck to apply on modern equipment. Complies with all A.A.R. requirements.

**NATIONAL
MALLEABLE &
STEEL CASTINGS CO.**

General Offices
CLEVELAND, OHIO

Sales Offices: New York, Philadelphia, Chicago, St. Louis, San Francisco.
Works: Cleveland, Chicago, Indianapolis, Sharon, Pa., Melrose Park, Ill.
Canadian Representatives: Railway and Power Engineering Corporation, Ltd., Toronto and Montreal.



Supply Trade Notes

W. W. WILLIAMS, general sales manager of the Babcock & Wilcox Tube Company, Beaver Falls, Pa., has been appointed general manager of the company, and T. F. Thornton, sales manager of the Detroit office district, has been appointed general sales manager.

THE SYMINGTON COMPANY, Rochester, N. Y., has changed its corporate name to The Symington-Gould Corporation and acquired the entire capital stock of The Gould Coupler Corporation (formerly The Gould Coupler Company). No change is contemplated in the policies, management or business operations of either company.

HAROLD BYRON SMITH has been elected president of the Shaperoof Lock Washer Company, Chicago, to succeed his father, the late Harold C. Smith. The other officers of the company are as follows: Frank W. England and Carl G. Olson, vice-presidents; Calmer L. Johnson, secretary and treasurer; Frank W. England, assistant secretary.

FERDINAND A. KEIHN has resigned his position as manager—Contract and Specification department of the J. G. Brill Company, Philadelphia, Pa., to establish his own business in the Rialto building in San Francisco, Calif. He represents several manufacturers whose products are sold to the railway industry. Mr. Keihn was associated with the International Motor Company (Mack trucks) for five years as designing engineer and later as special sales representative. The following twelve years he was employed by the J. G. Brill Company successively as sales engineer, New England sales representative, and manager.

THE ELECTRO-MOTIVE CORPORATION, LaGrange, Ill., a subsidiary of the General Motors Corporation, has awarded a contract to the Austin Company, Cleveland, Ohio, for a 504-ft. extension to the main erection and machine-shop bays. This extension will complete the original plans for this part of the plant's development which has been held up pending operating experience in the initial unit which was finished in January, 1936, and provides approximately 84,000 sq. ft. of additional plant capacity. Work will be begun at once so as to make the additional plant space available for operation early in the spring. The expenditure contemplated for building and equipment is \$750,000.

GEORGE B. CUSHING, who in 1931 organized a technical promotion group now known as the engineering service department of the A. M. Byers Company, Pittsburgh, Pa., has been appointed manager of sales promotion. Mr. Cushing joined the A. M. Byers Company in 1928 to organize and head its present advertising department. B. D. Landes, who has been in the technical group since its inception, has been appointed manager of the engineering service department. T. C. Winans, in the advertising department since 1930, has been appointed advertising manager. Both the manager of the engineering serv-

ice department and the advertising manager became a part of the newly formed sales promotion group headed by Mr. Cushing. R. H. Gardner, formerly of the Washington, D. C., office of the company, has been appointed manager of pipe sales and will take over all sales management duties in connection with wrought iron and steel tubular products.

NORMAN B. JOHNSON has been appointed assistant chief engineer in charge of mechanical engineering for all plants of the Pullman-Standard Car Manufacturing Company, Chicago. Mr. Johnson entered the employ of Armour & Company



Norman B. Johnson

in 1905, after which he was associated with the Chicago Railway Equipment Company from 1906 to 1909, and the American Car & Foundry Company at its Chicago plant from 1909 to 1916. In March, 1916, he became an engineer for the Haskell & Barker Car Company, and shortly thereafter was appointed chief draftsman, which position he held until November, 1919, when he went to France in connection with export war equipment. On his return in 1921 he became assistant superintendent of the Michigan City plant of Haskell & Barker, which position he held until 1928, when he was promoted to production superintendent of the same plant but of the successor company, the Pullman Car & Manufacturing Corporation, which later became the Pullman-Standard Car Manufacturing Company. He held the latter position until May, 1935, when he was transferred to the Pullman Car Works on special duty.

JULIUS KINDERVATER, former manager of the Alco plant of the American Locomotive Company at Richmond, Va., has been appointed resident manager of the Diesel Engine plant of the American Locomotive Company at Auburn, N. Y., and H. W. Bliss has been appointed manager of the Alco plant at Richmond, Va. Mr. Bliss formerly was superintendent of this same plant.

Julius Kindervater is a native of Richmond, Va., where he attended public and high schools, and, for four years, Virginian Mechanics Institute Night School of

Technology. He entered the Richmond Locomotive Works in January 1891, where he served four years as machinist apprentice, and then four years as draftsman apprentice. After three years in the drawing room on detail and elevation works he became general machine shop foreman, later maintenance engineer, which position he held until 1918 when he was transferred to the New York office as mechanical superintendent of the company. After three and one-half years in New York, Mr. Kindervater went back to Richmond as manager of the Alco plant.

H. W. Bliss was born in Providence, R. I., and after graduation from the public schools, took up a mechanical career with the Coleman Horse Shoe Nail Co., Pawtucket, R. I., where he remained for about 11 years. He then went with the Schoefield Manufacturing Co., builders of woolen machinery, engaged in sales and experimental work. Soon afterwards he became associated with the American Locomotive Company at Providence, builders of the Alco automobile, and progressed until he became chief inspector. He then served as a general foreman of the machine shop until the closing of the plant. He later re-entered the employ of the American Locomotive Company at Richmond and was sent to the E. W. Bliss Company to supervise the manufacture of machinery for the cartridge case department, later returning to Richmond as night foreman. He then went to Eddy-stone Munitions Company as general superintendent in the cartridge case department, and subsequently went to Kansas City, Mo., as superintendent of the Brass & Metal Company, makers of small arms munition. Returning to the Richmond plant of the American Locomotive Company he was engaged on shell contracts. On completion of this work he became night foreman of locomotive building and later assistant superintendent. He was then transferred to the Alco Accessory plant as general foreman and subsequently became superintendent.

Obituary

H. DURANT CHEEVER, chairman of the board of the Okonite Company, and president of the Okonite-Callender Cable Company, died of apoplexy in Paris, France, on October 23. Mr. Cheever had been chairman of the board of the Okonite Company for 10 years, and president for 20 years before that. He was a graduate of Harvard University (1888).

Roy E. CARTZDAFNER, chief engineer and purchasing agent of the Magor Car Corporation, died suddenly on November 12, at his home in Passaic, N. J. Mr. Cartzdafer was born at Somerville, Ohio, in 1883 and was a graduate of the Ohio State University. He was connected with the Kilbourne & Jacobs Manufacturing Company until 1916, when he entered the service of the Magor Car Corporation as chief engineer and later was appointed also purchasing agent.

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CAN YOU AFFORD

DAMAGE CLAIMS ACCOUNT OF PROTRUDING BOLT HEADS?

DAMAGE CLAIMS ACCOUNT OF LEAKY CARS?

REPAIR BILLS ACCOUNT OF SHEATHING ROTTED AT BOLT HOLES?

PENALTY DEFECTS ACCOUNT OF PROTRUDING BOLT HEADS IN
RUNNING BOARDS?

SHIPPERS COMPLAINTS AND CARS REJECTED WHEN SET FOR
LOADING ACCOUNT OF BOLT HEADS PROTRUDING IN
CAR FLOORS?



IF YOUR RAILROAD CAN'T AFFORD THESE EXPENSES,
YOU CAN ELIMINATE THEM BY SPECIFYING

"GRIP NUT COMPANY'S LEAK PROOF BOLT"



THE ONLY BOLT THAT SEALS THE BOLT HOLE WITH A PRESSURE SEAL.

Prevents rot around bolt hole.

Eliminates Leaks.

THE ONLY BOLT THAT LOCKS ITSELF IN THE WOOD.

Can't back up.

Heads can't protrude.

GRIP NUT COMPANY

5917 South Western Avenue

Chicago, Illinois

Personal Mention

General

B. M. BROWN, chief assistant superintendent of motive power and equipment of the Texas & New Orleans, has been appointed assistant general superintendent of motive power of the Pacific lines of the Southern Pacific, with headquarters at San Francisco, Cal.

F. R. HOSACK, master mechanic of the Gulf Coast Lines (part of the Missouri Pacific Lines) at Kingsville, Tex., has been appointed acting mechanical superintendent of the Missouri Pacific, with headquarters at St. Louis, Mo., to succeed W. H. McAmis, who has been granted a leave of absence.

F. J. JUMPER, assistant general mechanical engineer of the Union Pacific, has been appointed acting general mechanical engineer, with headquarters as before at Omaha, Neb., succeeding A. H. Fetters, who has retired.

J. S. NETHERWOOD, assistant superintendent motive power and equipment of the Southern Pacific at Algiers, La., has been transferred to Houston, Tex., and the position of assistant superintendent motive power and equipment at Algiers as well as that of chief assistant superintendent motive power and equipment at Houston, which has been held by B. M. Brown, have been abolished.

Master Mechanics and Road Foremen

J. W. LEONARD has been appointed assistant master mechanic of the Philadelphia division of the Pennsylvania, with headquarters at Harrisburg, Pa.

J. E. FRELS, roundhouse foreman of the Southern Pacific at Yoakum, Tex., has been appointed master mechanic at Ennis, Tex., to replace W. Donohue.

F. L. CARSON, master mechanic of the San Antonio division of the Southern Pacific, with headquarters at San Antonio, Tex., has had his jurisdiction extended to include the Victoria division.

A. O. GEERTZ has been appointed assistant master mechanic of the Middle division of the Pennsylvania, with headquarters at Altoona, Pa.

E. A. BURCHIEL, road foreman of engines of the Pennsylvania at Ft. Wayne, Ind., has been appointed road foreman of engines of the Grand Rapids division, with headquarters at Grand Rapids, Mich.

T. OLSON has been appointed master mechanic of the Chicago Great Western, with headquarters at Oelwein, Iowa, succeeding J. S. Morris, who has been assigned to other duties.

H. D. ALLEN, road foreman of engines of the Grand Rapids division of the Pennsylvania at Grand Rapids, Mich., has been appointed road foreman of engines of the

Ft. Wayne division, with headquarters at Ft. Wayne, Ind.

Shop and Enginhouse

W. DONOHUE, master mechanic of the Southern Pacific Lines in Texas and Louisiana, with headquarters at Ennis, Tex., has been appointed superintendent of shops, with headquarters at Algiers, La.

Car Department

C. G. TOLBERT, car foreman of the Norfolk & Western at Kimball, W. Va., has been promoted to the position of foreman of the Buchanan branch, with headquarters at Weller Yard.

C. A. HENSLEY, gang leader of the Norfolk & Western at Wilcoo, W. Va., has been promoted to the position of car foreman, with headquarters at Kimball, W. Va., succeeding C. G. Tolbert.

Purchasing and Stores

A. W. HIX has been appointed to the newly created position of assistant to the chief purchasing and stores officer of the Chesapeake & Ohio, the New York, Chicago & St. Louis and the Pere Marquette, with headquarters at Cleveland, Ohio.

Obituary

N. DYSERT, general car inspector of the Missouri Pacific at Little Rock, Ark., died on August 29.

Trade Publications

Copies of trade publications described in the column can be obtained by writing to the manufacturers. State the name and number of the bulletin or catalog desired, when mentioned in the description.

CENTRIFUGAL PUMPS.—The Worthington Pump and Machinery Corporation, Harrison, N. J., has issued a bulletin descriptive of centrifugal pumps for railroad car air conditioning.

GARLOCK KLOZURE OIL SEAL.—A 40-page illustrated booklet descriptive of the characteristics, installation and general applications of the Garlock Klozure oil seal has been issued by the Garlock Packing Company, Palmyra, N. Y. Tables of standard Klozure sizes indicate the shaft sizes most commonly used with the bore diameters shown.

CUMMINS ENGINES.—Among the new booklets released by the Cummins Engine Company, Columbus, Ind., dealing with Diesel engines is an attractively illustrated bulletin which describes fuel injection systems and the difference between the individual pump of the high-pressure type and the Cummins low-pressure distributor type of fuel pump.

HEAT TRANSFER SURFACES.—Bulletins Nos. 536 and 636, respectively, issued by the Young Radiator Company, Racine, Wis., describe Young radiators and heat transfer products and surfaces for air conditioning and special applications.

BURNISHING ROLLERS.—The Haynes Stellite Company, a unit of the Union Carbide and Carbon Corporation, Kokomo, Ind., has issued a four-page illustrated folder describing the advantages of burnishing railroad car-axle journals, locomotive driving axle journals, piston rods, crank pins, etc., with Haynes Stellite rollers.

ODOR ADSORBERS.—“Consolidated Odor Adsorbers in Air Conditioning” is the title of an eight-page booklet published by the Consolidated Air Conditioning Corporation, 114 East Thirty-second street, New York. The booklet covers the question of cost of operating an air-conditioning system and stresses the necessity of reducing the amount of “make-up” air. Tables show the savings effected by reducing the amount of make-up air.

OPERATOR'S INSTRUCTION BOOK.—This instruction book, distributed by the Landis Machine Company, Waynesboro, Pa., gives detailed data covering the care and operation of standard pipe-threading and cutting machines, as well as the Landis receding chaser pipe-threading and cutting machine. It also contains complete information regarding the grinding and setting of chasers for use in these die heads and machines.

DIESEL-ELECTRIC TRAINS.—Publication GEA-1928, issued by the General Electric Company, Schenectady, N. Y., contains pictures and performance features of seventeen high-speed Diesel-electric trains now operating in the United States. The pamphlet outlines the history of high-speed Diesel-electric rail transportation from the advent of the original Burlington Zephyr in 1934, and includes descriptions of the Flying Yankee, the Abraham Lincoln, the Green Diamond, the Super Chief, the City of Los Angeles, City of San Francisco, City of Denver and the later Burlington Zephyr.

VANADIUM STEELS FOR LOCOMOTIVE AND CAR CONSTRUCTION.—In its review of vanadium steels for locomotive and car construction the Vanadium Corporation of America, 420 Lexington avenue, New York, covers specific applications of carbon-vanadium steel (forgings and castings); nickel-vanadium steel (castings); chromium-vanadium steel (elliptic springs); silicon-vanadium steel (helical springs), and manganese-vanadium steel (forgings and castings, plates and shapes, rivets and engine bolts). The tensile properties for each type of steel under recommended methods of heat treatment are given and the relationship of these properties to the applications suggested is discussed. Bound with the text are detailed specification sheets covering standards of manufacture, heat treatment, chemical composition, testing and inspection for the fourteen classifications of vanadium steels recommended for application in locomotive and car construction.

This Pipe has shed its Scale ... two hands full!



NATIONAL Scale Free PIPE *"It's Spellerized"*

NATIONAL Scale Free Pipe is exactly what the name implies . . . pipe free of mill scale — clean and smooth inside as well as out.

In all NATIONAL butt-welded Pipe (Sizes $\frac{1}{2}$ inch to 3 inches) a special process invented and developed by National Tube Company mechanically removes the welding scale from both interior and exterior. The pipe reaches you smooth and clean. No scale is left to clog small orifices, to injure meters, or otherwise interrupt service. Damage to valves is prevented. By getting rid of mill scale, which

is strongly electro-negative to pipe metal, we eliminate the prime source of corrosion, pitting, and pipe deterioration. That is why NATIONAL Scale Free Pipe lasts longer in service, maintains its ability to deliver full capacity, keeps pipe line maintenance low, makes repairs to costly equipment unnecessary.

NATIONAL Scale Free Pipe is strong and ductile, threads well, flanges readily, coils and bends satisfactorily. It is uniform in metallic structure, in diameter and wall thickness. Thorough testing and inspection assure its high quality.

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UNITED STATES STEEL

Yes.

2

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Above—USS COR-TEN can be welded by the usual shop methods. For most applications any mild steel electrode is satisfactory. For extremely corrosive conditions a coated COR-TEN electrode is available.

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2—Hot pressing a corrugated longitudinal hood for hopper car in USS COR-TEN.

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can be fabricated economically

. . . and with only minor
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THE experimental period of Cor-Ten fabrication is passed. Practically every question involving shop methods has already been answered. You are not breaking new ground when you build with USS Cor-Ten.

Today we have available the accumulated experience of numerous builders who have used this superior low alloy steel in the construction of light-weight, high-strength freight equipment that is setting new standards of operating economy. In cars of every description — hopper cars, box cars and refrigerator cars — USS Cor-Ten has demonstrated adaptability and ease of fabrication comparable to that of ordinary steel.

USS Cor-Ten is readily arc welded or

spot welded. Cold flanging and cold forming present little difficulty. No heat treatment is required after hot pressing. As compared with mild steel, USS Cor-Ten has approximately twice the yield point, one-and-a-half times the ultimate strength, and nearly two times the impact resistance. Its resistance to atmospheric corrosion is from four to six times that of ordinary steel.

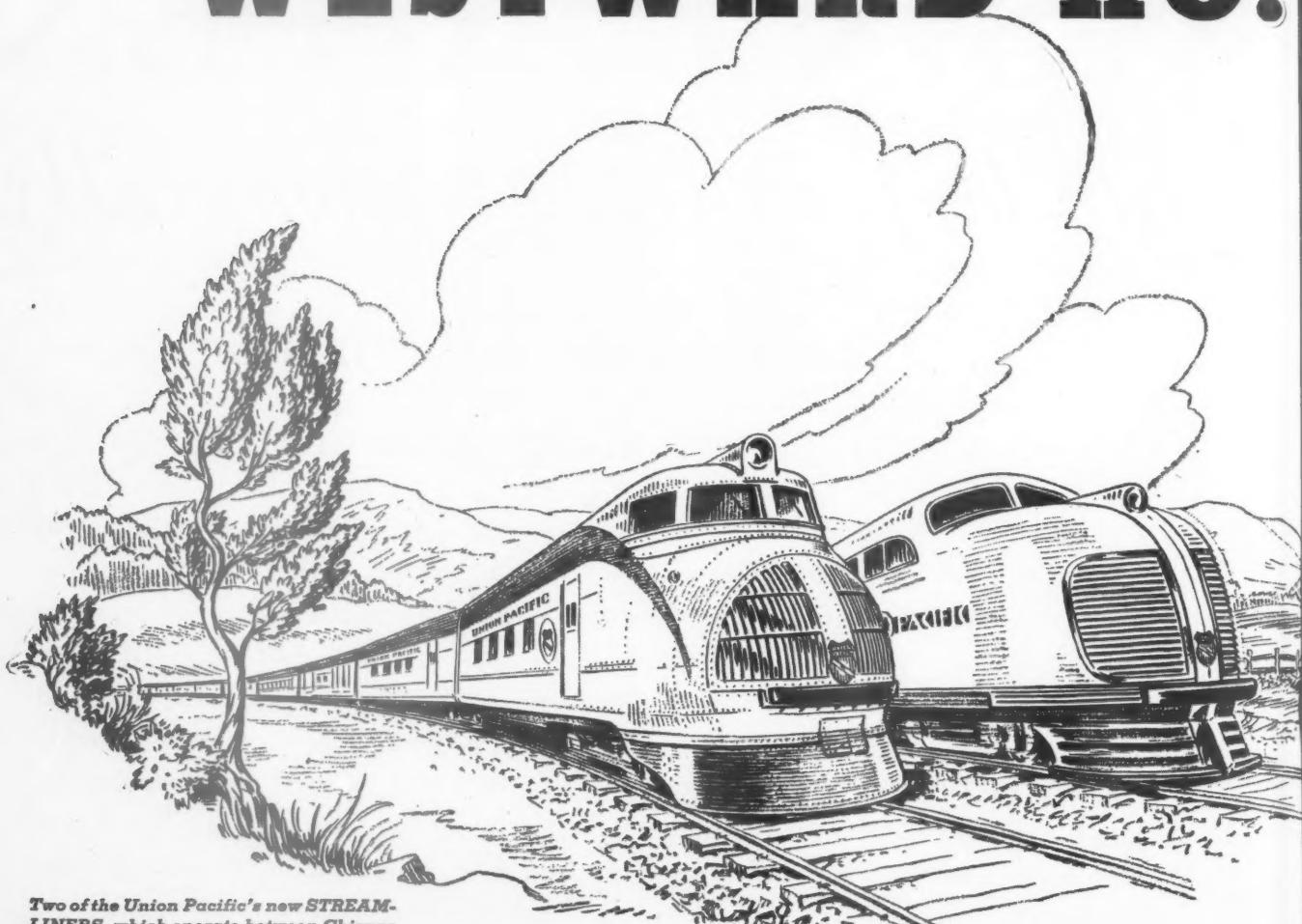
To learn how well USS Cor-Ten and other USS High Tensile Steels fit into your rehabilitation and modernization program, how little they increase cost, how best to build with them, address Railroad Research Bureau, United States Steel Corporation Subsidiaries, Pittsburgh, Pennsylvania.

AMERICAN STEEL & WIRE COMPANY, Chicago and New York . . . CARNEGIE-ILLINOIS STEEL CORPORATION, Pittsburgh and Chicago . . . COLUMBIA STEEL COMPANY, San Francisco . . . NATIONAL TUBE COMPANY, Pittsburgh . . . TENNESSEE COAL, IRON AND RAILROAD COMPANY, Birmingham . . . COLUMBIA STEEL COMPANY, SAN FRANCISCO, Pacific Coast Distributors . . . UNITED STATES STEEL PRODUCTS COMPANY, NEW YORK, Export Distributors



UNITED STATES STEEL

WESTWARD HO!



Two of the Union Pacific's new STREAM-LINERS, which operate between Chicago and the principal cities of the West



The DENVER ZEPHYR, newest of the Burlington's ZEPHYR Fleet

G E N E R A L

Speeding Diesel-Electrics Attract More Passengers — Earn More Revenue

PIONEERS in new transportation — bringing the frontiers closer together — linking the Far West with the cities of the East. Fast, diesel-electric trains cut many hours from the time previously required between Chicago and the West. Air-conditioned cleanliness and the comfort of smooth sailing bring new passenger traffic—and more profits.

Speeding along at an average of nearly a mile a minute, rolling up to nearly a hundred miles an hour in stretches, the lightweight, diesel-electrics are modern in every detail. Small wonder that passengers are attracted to their time-saving and luxury!

Why do progressive railroads choose diesel-electric motive power? Because the records of everyone of the new streamlined, lightweight, diesel-electric trains show

that passenger traffic is increased. And this extra business has meant a splendid return on the investments.

Increased passenger traffic alone does not constitute the profit-making features of diesel-electrics. These power units are setting amazing mileage records. Each is taking the place of several standard locomotives because they do more work—stay in service day after day. In addition, fuel costs are 50 per cent lower, and decreased maintenance costs mean additional savings.

Electric drive is the ONLY practical method by which the power of giant diesel engines can be transmitted smoothly to the wheels. The public wants this kind of transportation and has proved it—these ultramodern trains are revenue-getters and they have proved it. When will your road join the parade of the streamlined trains? General Electric, Schenectady, N. Y.



The SUPER CHIEF, transcontinental flyer of the Santa Fe, is pulled by a 3600-hp twin-unit, diesel-electric locomotive.

E L E C T R I C

**50%
Faster**



ON THE VERTICAL TURRET LATHE

NOT merely one or two parts but over 75% of all boring and turning jobs machined in a railway shop.

BULLARD production and BULLARD versatility make the Vertical Turret Lathe an indispensable unit. It can be kept busy, saving money when other tools are idle.

Multiple tooling—multiple cutting—correct engineering—superior materials and expert workmanship are the outstanding features.

It's a veteran railroader—designed for the job—built for the job and fast on the job. Be sure to figure on a sufficient number of Vertical Turret Lathes in your shop modernization program.

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THIS FOLDER describes a modern method of turning locomotive frame bolts — turning them *on a production basis*. The speed and accuracy of the J&L Taper Bolt Machine definitely put it in the class of money makers whether used for taper bolts or other turret lathe work. Your start toward making real money on turning jobs may lie in the coupon. Send it in. There is no obligation, of course.

JONES & LAMSON MACHINE COMPANY
SPRINGFIELD, VERMONT, U. S. A.

Without obligation please send the new folder "Machining Locomotive Frame Bolts on the J&L Taper Bolt Machine."

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Toughness plus

FOR rough-and-tumble SERVICE

BETHLEHEM Omega Tool Steel brings a truly formidable combination of physical properties to bear on the tough, impact-resisting jobs of shop, mill and mine. It is right in its own element under the relentless, staccato battering of pneumatic hammers. Omega bears up under punishment that would quickly break down anything but a super-shock-resisting steel.

Omega has no equal as material for pneumatic and hand chisels, rivet sets and busters, blacksmith tools, beading tools, calking tools and punches. It is also being widely used for shear blades.

When Bethlehem Omega Tool Steel is heat-treated, a tensile strength of

340,000 pounds per square inch can be obtained in combination with an Izod value of 7 foot pounds. A slightly higher drawing temperature produces even greater toughness—an Izod value of 15 foot pounds—with but a slight reduction in tensile strength to 320,000 pounds per square inch.

Omega forges readily at a temperature of approximately 1750 deg. F. No expensive heat-treating equipment is necessary. It responds to a wider temperature range than carbon steels.

For other tool steel tasks Bethlehem makes other steels, each an equally outstanding performer in its own particular field.

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OMEGA
TOOL STEEL**

BETHLEHEM STEEL COMPANY



NEW LIGHT ON AN OLD PROBLEM



THE
ARCH



THE
TRIANGLE



THE
COUNTER-
BALANCE



The BALDWIN DISC WHEEL is a long step forward in the search for lighter, stronger wheel construction and better counterbalance.

Two basically strong sections—the TRIANGLE and the ARCH—both inherently light, are incorporated in the design.

A request from you for a study of your problem will have our prompt attention.

THE
BALDWIN
LOCOMOTIVE WORKS
Philadelphia, Pa.

The
NEW ZEPHYR



*Wings its
Westward Way all
Through the Night—SAFELY*

FLASHING through black darkness like a silver streak, the new Burlington Zephyr speeds over-night passengers from Chicago to Denver—SAFELY. Midway it passes its companion train on the return trip . . . Supplementing a fleet already rendering noteworthy service at various points on the Burlington Lines, these ten-car trains are of the latest streamlined construction, providing distinctive accommodations in parlor cars, coaches, and sleeping cars . . . The swift operation of these nightly carriers is safeguarded by Westinghouse Air Brakes, the improved HSC Equipment—highly efficient and effective.



WESTINGHOUSE AIR BRAKE CO.

GENERAL OFFICE AND WORKS

WILMERDING, PA.

OXYACETYLENE WELDING OXWELD REPAIRS on cylinders *restore locomotives to service promptly*



OXY-ACETYLENE welding of locomotive cylinders under Oxweld Railroad Service procedures is resulting in profits for the railroads. It shortens shop delays and restores damaged locomotives to service at low cost.

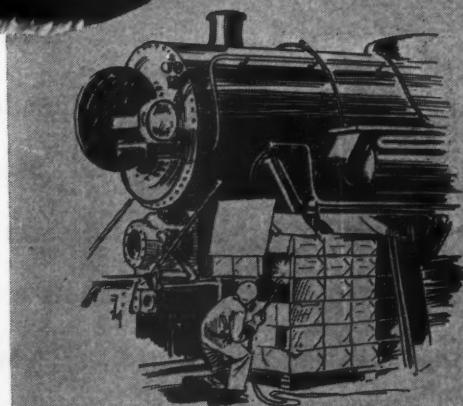
Welds in either cast-iron or cast-steel cylinders can be made by oxy-acetylene welding. Special Oxweld welding rods and welding apparatus, together with Oxweld supervision which follows closely at every step of the work, insure the high quality performance of welded cylinders.

Oxweld Railroad Service brings to railroad shops the advantages of a most unique coordination of scientific research with manufacturing and service facilities. Through these benefits for almost a quarter of a century The Oxweld Railroad Service Company has served the welding and cutting needs of a majority of the Class I railroads.

THE OXWELD RAILROAD SERVICE COMPANY
Unit of Union Carbide and Carbon Corporation

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New York: Carbide and Carbon Bldg. Chicago: Carbide and Carbon Bldg.



Repairing a broken locomotive cylinder by the Oxweld process makes the cylinder like new.





Of course you wouldn't give Wyandotte as a Christmas present to your family or friends. But while you're enjoying a Merry Christmas in your home don't forget to give your business a Christmas present, too. Give it Wyandotte, and your business, and you, will enjoy a Happy and Prosperous New Year.



SEASON'S GREETINGS

THE J. B. FORD COMPANY • WYANDOTTE, MICH.

THE PACE IS HOT.. BUT THE BEARINGS KEEP COOL



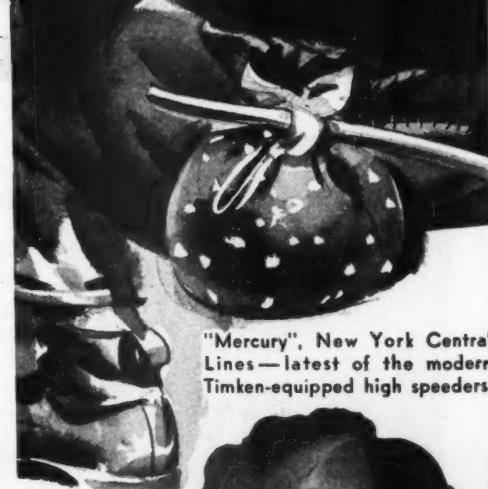
Fifty miles an hour was a good average speed for railroad trains a few years ago. Sustained speeds of eighty, ninety, a hundred miles an hour and even higher are becoming quite common today.

Streamlining gets a lot of the credit—and rightly so—but the major share must go to the roller bearings with which, without a single exception, all modern high-speed trains are equipped.

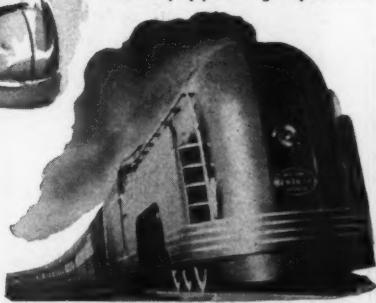
Even in the old days, at speeds ranging from fifty to seventy miles an hour, hot boxes were the cause of more train delays and detentions than any other factor.

What chance would friction bearings have under the Burlington "Zephyrs", the Union Pacific "City of San Francisco", the Illinois Central "Green Diamond", the New Haven "Comet", the Milwaukee "Hiawatha", the New York Central "Mercury"—and many others!

These famous trains pursue their swift daily courses on Timken Bearings—unhampered by lubrication troubles, hot boxes and attendant evils. If you want to keep up with the times you must have roller bearings in your trains—as well as air conditioning, improved seating and other modern features.



"Mercury", New York Central Lines—latest of the modern Timken-equipped high speeders.



THE TIMKEN ROLLER BEARING COMPANY, CANTON, OHIO

TIMKEN TAPERED ROLLER BEARINGS

You Need These Tools and



Boring cylinders and valve chambers with UNDERWOOD Portable Boring Bars are simple and economical operations. The work is done quickly, easily and with complete accuracy. Locomotives can be returned to revenue service at once.

Your Road Needs the Savings

WHY waste any more time and money repairing those old obsolete portable tools which require hours for set-up and careful nursing during the machining operation?

The savings offered by UNDERWOOD Portable Tools will quickly pay for the replacement.

Why not check up on the condition of your units—the cost of repairs and the time required for each job? Then write us for performance data. Comparison of figures will prove to you that replacement should be started immediately.

**H. B. UNDERWOOD CORP.
Philadelphia, Pa.**

- Valve Chamber Boring Bars
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- Crank Pin Turning Machines
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- Slide Valve Seat Turning Machines
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PORTABLE TOOLS**

New Fourth Edition

TRAINS, TRACKS and TRAVEL

By T. W. VAN METRE

Professor of Transportation, Columbia University

A new edition of this popular elementary book on railroading is just off the press. It has been thoroughly revised and obsolete illustrations have been replaced to show latest equipment. There is a new chapter on streamlined trains and additions to others cover recent developments in air conditioning, air brakes and Diesel and electric locomotives.

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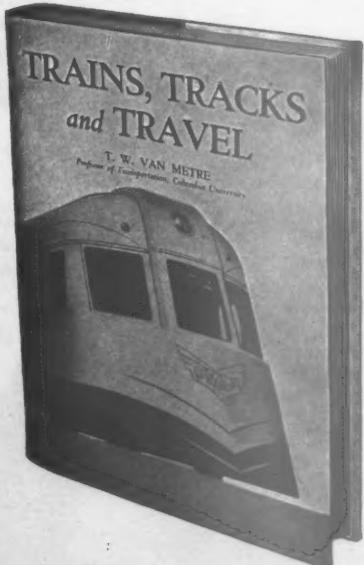
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From

FISH

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BLACKBERRIES



"Powerful" fish odors now removed from refrigerator cars more easily, quickly

No need to tell Superintendents of Transportation . . . Car Department Supervisors . . . Car Foremen and others responsible for conditioning refrigerator cars about decayed fish odors. Your nose can detect them long before you see the car. Few, if any, odors are more powerful, more difficult to remove. Formerly, when a car previously carrying fish had to be made ready for fruit, a REAL tough problem confronted those who had the job to do. But NOW, you can clean and sterilize a refrigerator car that has carried fish and do it easily, do it better and at lower cost, so that no odors remain.

New, Low-Cost Method of CLEANING & STERILIZING REFRIGERATOR CARS A Revelation in Efficiency

A refrigerator car in the yards of a well known road had carried fish. It had to be made ready to ship blackberries. Previous methods of cleaning similar cars had not been wholly satisfactory. Fish odors were not entirely removed and besides, the method employed cost too much in time and money. A new Oakite method for cleaning and sterilizing was tried. It proved a revelation in efficiency. The time of doing

the job was reduced more than 35%! Cost was materially lowered! Most important were the RESULTS. Absolutely NO odor of fish remained and car was clean and sweet-smelling, ready for shipment of blackberries. Or in fact, any other perishable fruit product.

Ask us . . . without obligation on your part . . . to send you the interesting details of this new, highly efficient, money-saving Oakite method.

Manufactured only by

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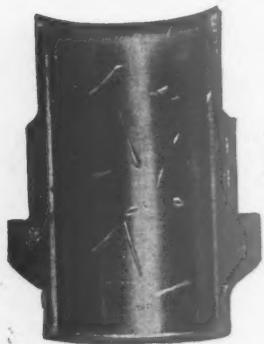
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SPECIALIZED INDUSTRIAL CLEANING MATERIALS & METHODS

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TO-DAY
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TEST PROVES



*You can't
LUBRICATE
this bearing*

Here's What Happens



Look at those nicks—typical injuries received by many new bearings before they reach the journal. When placed in service, the small raised area surrounding each nick bears the whole load—as much as ten tons on less than a square inch of surface. No oil in the world will hold a film under such pressure. Result, metal to metal contact, rapid heating of the bearing. Furthermore, oil drains into the depression, creating a dry ring around the journal. The bearing must run hot.

Many a hot box can be prevented by eliminating damage to bearing linings. Macer Protectors, applied to bearings at the foundry, give full protection—*make every replacement bearing a perfect bearing*. Used many times, Macer Protectors give this vital service at small cost. If a bearing is worth broaching it is worth protecting. Write for full details.



MACER Journal

PATENT NO. 2,041,744

Bearing Protector

LEWIS BOLT & NUT CO.

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SHAKEPROOF TAPPING SCREWS

WITH STANDARD
MACHINE SCREW
THREAD



TAP AND FASTEN IN ONE OPERATION

Because they actually cut their own threads, IN METAL OR MATERIALS OF PRACTICALLY ANY THICKNESS, Shakeproof Tapping Screws eliminate the expensive tapping operation. And, because they fit snugly in the threads they cut, they draw the parts together tightly and fasten more securely than ordinary machine screws in pre-tapped holes. If replacement is ever necessary, an ordinary machine screw may be used as the thread is standard.

SAVE TIME - CUT COSTS SPEED UP PRODUCTION

Shakeproof Tapping Screws have proved themselves the ideal fastening method for modern transportation construction. Leading shops and car builders have found they can reduce costs materially and speed up production by eliminating tapping. Remember, when you use Shakeproof Tapping Screws no special tools are required—no changes in present shop practice or constructional details are necessary. Send for your Free Demonstration Kit and make your own tests on your own work! Write for it today.

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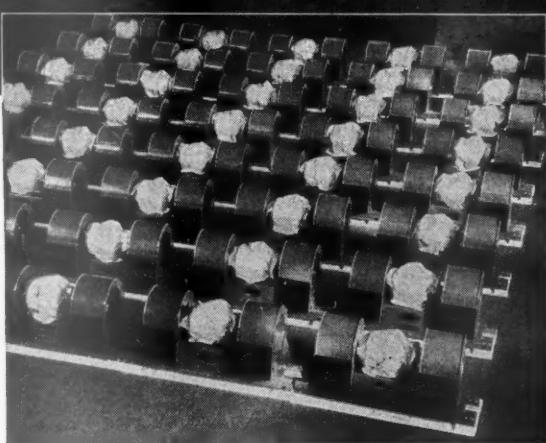
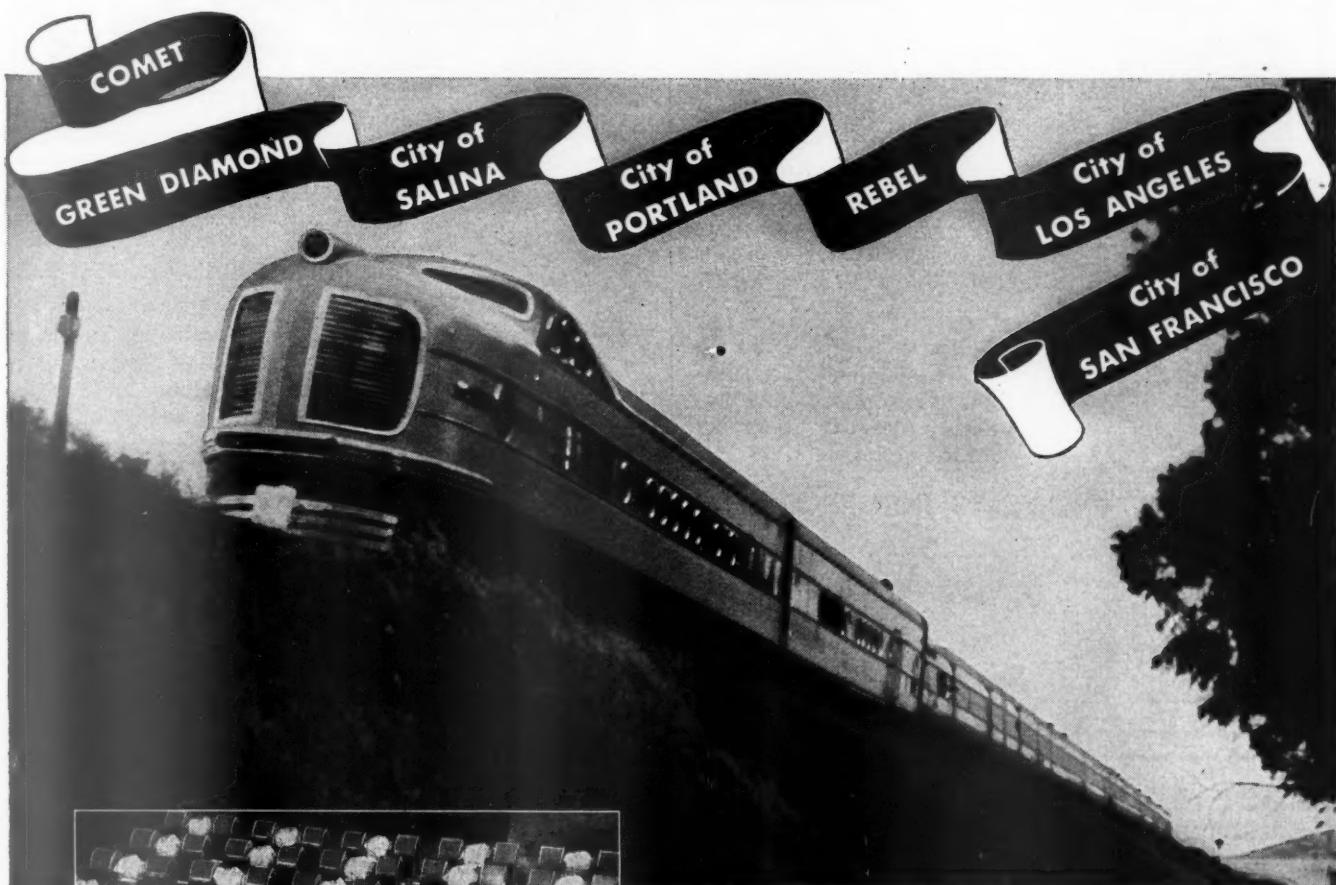
Copr. 1936
Illinois Tool Works

IN CANADA: Canada Illinois Tools, Ltd.
Toronto, Ont.

U. S. Patent Nos. 1,862,486—1,909,476—
1,909,477—Other Patents. Patents
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KIT.... FREE!

7 RECENT***Streamlined TRAINS***

Part of a large shipment of Sturtevant air circulating units to be used for air conditioned cars.

**UNITS OR SYSTEMS**

are now used by 37 railroads. Railvane Air Conditioning is protected by 25 basic issued patents and other patents pending.

FOR 25 YEARS...PIONEERS IN AIR CONDITIONING

**Equipped with Sturtevant
Fans for air conditioning
and engine cooling**

Over 6000 passenger cars on 37 railroads are now equipped with Sturtevant Railvane Air Conditioning Units or Systems. Many of these cars are also equipped with Sturtevant Railvane Air Distributing Systems.

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ORDERLY STORAGE

in Labeled Compartments



Any good tool is worth the fraction of a cent it costs per tool to protect it for 10 years in this Lyon Steel Tool Crib. Every tap drill reamer and die assigned to it has a regular labeled shelf location or compartment. Size 3'x1'x7'; net weight 241 lbs. Can be furnished at some extra cost with swing doors and a lock. As shown, is far superior to any make-shift tool rack and costs only—

\$35.00 Send for Catalog 1534 containing full description. Or, order one as preliminary tryout to equipping tool room complete.

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LYON Service

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SERVICE-TESTED CAR PARTS
and save or spend the difference

IRON & STEEL PRODUCTS, INC.
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Car Parts, Freight, Passenger and
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Wanted advertisements appearing in the "Get Together Department," 10c a word an insertion. Minimum charge \$2.00 for each insertion. For Sale advertisements \$10.00 a column inch. Any number of inches may be used. Copy must be in this office by the 10th of each month preceding to insure insertion in the issue.



LUNKENHEIMER
A.A.R.
VALVES

for Locomotives

300 lb. SP., 550° F.

Available in inside and outside screw patterns, globe and angle, and with male or female inlet, union outlet connections. All patterns are made in both full-way and plug type.

Illustrated in the new A. A. R. valve circular No. 530. Write for your copy.

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"QUALITY"
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Old Address

Position Company

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KING Mechanical Lubricator



MODEL 31-14
Maximum of 14 Feeds
Capacity 30 Pints

Rugged - Efficient - Economical

In addition to these three essential characteristics the KING Mechanical Lubricator has a number of unique features which insure dependable service for many years with minimum attention.

The pumps are of a straight displacement type—bodies are of government bronze—pump plungers are of tool steel; hardened and ground to precision fits.

The entire pump assembly can be easily removed for inspection and cleaning. Oil feeds leading out of top of reservoir simplify application and maintenance of oil tight joints.

KING Mechanical Lubricators are made in two sizes—24 and 32 pint capacities with a maximum of 8 and 14 feeds. The number of feeds of each size reservoir can, of course, be varied to suit requirements.

THE U. S. METALLIC PACKING CO.
PHILADELPHIA PENNSYLVANIA

KING PRODUCTS

Canadian
equipped 380.
B A R C O Locomotive
National

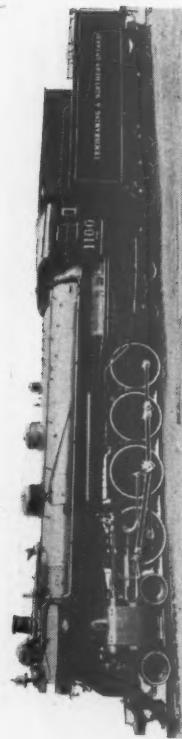


here shown for Canadian railroads. They were equipped with BARCO Metallurgical gears, between locomotive and tender, piping, reverse gear, between BARCO rear of tender and connection, BARCO recognition of BARCO. Such use of railroads that by leading management on value and pends on first choice. BARCO is first reliable, safe, reliable performance at lower cost.

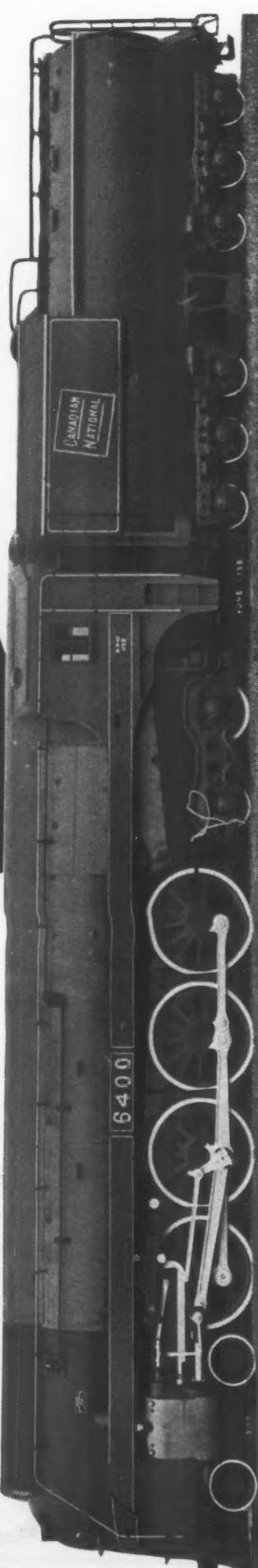
BARCO equipped
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Canadian 6162.



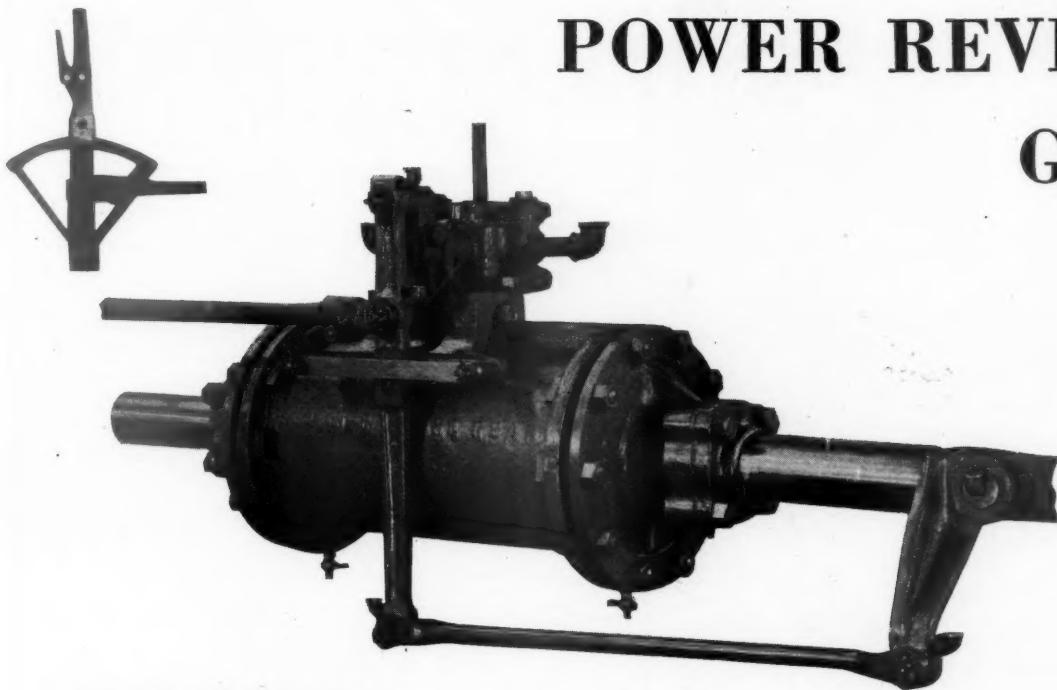
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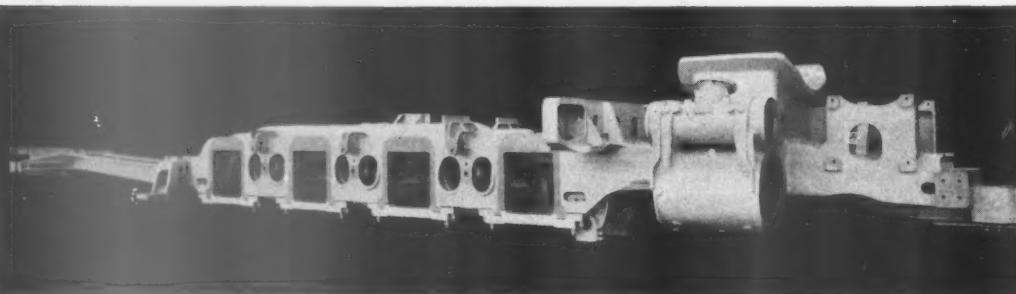


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VOL. 110

No. 12

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